Quantitative target setting in balanced scorecard method using simultaneous equations system and goal programming

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Abstract

Purpose – The purpose of this paper is to identify the accurate cause and effect relationships among strategic objectives and also to demonstrate how decision makers can be guided in the process of defining quantitative strategic target values in the framework of balanced scorecard (BSC) and performance measurement system.

Design/methodology/approach – Based on the proposed method in this research, after determining strategic objectives and developing an initial strategy map according to decision makers' opinions, simultaneous equations system (SES) was used to determine the significance of the relationships among strategic objectives in higher perspectives of the BSC and corresponding strategic objectives in lower perspectives. Afterward, desirable values for performance measures were determined based on the equations and relationships obtained through SES and were optimized by goal programming method.

Findings – By applying the proposed method, a clearer picture of the associations among strategic objectives is obtained and the influence of strategic objectives on one another is determined. Afterward, optimal values for strategic objectives are determined to achieve the organization's goals.

Research limitations/implications – This paper proposes a framework for constructing a strategy map and setting quantitative targets in the framework of BSC. Indeed, this paper presents a case study to demonstrate the applicability and effectiveness of the proposed approach. However, SES technique requires a greater amount of data to generate more accurate results. Although the advent of the Information Age has forced organizations' decision makers to provide sufficient information and data for business analysis, the data requirements are met.

Practical implications – The presented quantitative approach is a supporting approach for improving decision makers' opinions and enabling them to reach a more accurate picture of the relationships, valuing strategic objectives and achieving strategic goals. This research also presents a case study to demonstrate the applicability of the proposed approach. The application and implication of the proposed method in banking services show that the contributions of the paper are not only theoretical, but also practical.

Originality/value – The proposed method provides a novel approach for determining the most appropriate targets and applies a comprehensive and scientific model together with decision makers' opinions and experiences and has two main contributions: first, the associations among strategic objectives are investigated and obtained in an effective way by conducting the SES for the first time in the framework of BSC. Second, quantitative targets have been determined to help in achieving the long-term goals. This task has been accomplished through a combination of SES, the three-stage least squares regression analysis and optimization by using weighted goal programming method.

Keywords Balanced scorecard, Goal programming, Simultaneous equations system, Target setting

Paper type Research paper

1. Introduction

"Balanced scorecard" (BSC; Kaplan and Norton, 1992) method is one of the most prevalent approaches for the design, strategy implementation and organization performance evaluation. It incorporates financial and other measures such as customer focus and satisfaction, internal business processes, and learning and growth, to measure quantitatively and qualitatively the

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overall organizational performance using a firm's external and internal information. This approach provides managers with a comprehensive picture of an organization's performance in order to measure its progress toward reaching its strategic goals (Kaplan and Norton, 1992, 1996a, 2008).

The BSC framework can help organizations to translate their strategic objectives into a coherent set of performance measures. The BSC features four perspectives (financial, customer, internal processes, and learning and growth/innovation) which explain how the strategic objectives of an organization can be achieved. Each objective has to be expressed in terms of a measurable key performance indicator (KPI) with a target level so that the responsible employees know how much of this measure has to be achieved in a given time frame and organizations can be sure that the achievement of the BSC's objectives ensures reaching their strategic goals. The strategy map forces BSC-implementers to think about specific goals they want to achieve and how they need to be measured (Lueg, 2015a, b).

Although the BSC method has attracted a lot of attention and is widely accepted by organizations, there are several weak issues in this approach which need further research (Malmi, 2001).

Other researchers have also identified the limitations of BSC. They believe that the BSC does not stipulate how compromises are to be made between dissimilar measures and the four perspectives. Further, it is necessary to use a benchmarking exercise for identifying appropriate targets for each performance measure. Besides, measures in BSC are equally weighed. In reality, the comparison of measures shows that some of them may be more significant and may have a superior weight. Also measures in the BSC are located in a cause and effect chain in a slightly systemic approach, ignoring any feedback loops that exist (Tan *et al.*, 2017; Chytas *et al.*, 2011; Grigoroudisn *et al.*, 2012; Amado *et al.*, 2012).

Despite the fact that most recent researchers have developed and improved the original concept of BSC, different authors have highlighted the need to develop studies regarding the introduction and implementation of the BSC to improve this model (Tayler, 2010; Modell, 2012; Lueg and Silva, 2013; Hoque, 2014; Madsen and Stenheim, 2015; Lueg and Julner, 2014; Lueg, 2015, b).

According to what was mentioned above, it can be concluded that one of the issues regarding the BSC is that causality is not completely incorporated in its implementation. Moreover, it is not possible to determine the reasons for achieving or not achieving the performance objectives properly. It is also necessary to reach an understanding about the relationship between various aspects of the BSC method and KPIs.

Moreover, the qualitative nature of strategic and organization goals can be a challenge by itself. Optimal identification and categorization of measures necessitate considering these two important points (Farokhi and Roghanian, 2018):

(1) selecting and focusing on measures relevant to each strategic objective and considering the precise and correct cause and effect relationship between measures in various perspectives and designing the strategy map; and

(2) determining quantitative target values for each measure.

In fact, a problem in the implementation of BSC model is the adjustment of quantitative values for each measure relevant to strategic objectives on the strategy map. In order for managers to control objectives and strategies successfully, it is necessary to find a clear relationship between quantitative targets corresponding to each performance measure and the organization's vision and goals. What often happens during the implementation of the BSC model in organizations is that in each model perspective and for each strategic objective on the strategy map, one or more measures are defined. However, to what desired state the quantitative target of each measure must reach in the future from its current state is often done based on previous data and determining a certain growth value usually in an intuitive and judgmental manner (Farokhi and Roghanian, 2018).

When setting targets for performance measures, the organization managers do not know what changes would happen to their goals if all of the measures reach their desired value within the specified period of time. This is considered a shortcoming of the BSC model.

What should be noted with regard to the problem in this research, that is, adjusting performance objective values within the framework of the BSC is that organization managers need to simulate various scenarios for their goals to obtain an optimal combination of target values. Such simulations enable them to have an estimation of the value of the outcome variable for every new scenario. As a result, in order to model such a problem mathematically, a method is required which can provide an approach for identification, investigation and performing operations on various combinations of variable values (Farokhi and Roghanian, 2018).

Simultaneous equations system (SES) and goal programming are the methods which can provide such possibilities in this problem. In fact, causal approaches such as simultaneous equations could provide a better understanding of how strategic objectives interact to create the organization's goals. Furthermore, the desirable values of performance measures were assessed by using the goal programming approach. In fact, since achieving all the objectives in the real world is very difficult and in many cases impossible, in the current research, the goal programming approach aims at reducing deviation from the goals.

Reviewing the literature on setting quantitative targets for performance measures within the framework of the BSC showed no prior study in which SES and goal programming were used. The present research uses these methods to determine and improve quantitative values for the performance measures. Also, in terms of methodology, this research can be considered as innovative using SES and goal programming methods in performance and strategic management problems.

In fact, the proposed approach contributes to the BSC field of study by providing an analytical approach for identifying the linkages, direction and the relations among the strategic objectives and facilitates consensus authorizing the managers to construct the strategy map by applying a comprehensive, scientific and experimental approach based on their knowledge and experiences.

In this research, considering performance evaluation structure based on the BSC, quantitative targets are determined to achieve the organization's goals using goal programming in a combination of designed parameters, SES and optimization.

This paper is organized into five sections: the introduction part is introduced in Section 1. The concepts of BSC and the relevant literature are reviewed in Section 2. The proposed framework for constructing a structural model of strategy map and setting quantitative targets by using SES and goal programming method is described in Section 3. Section 4 illustrates an empirical case study including the selection of the indicators of BSC performance measurement, the construction of the strategy map, and the resulting analyses and discussions. Finally, the conclusions and some of the important suggestions for future research are proposed in Section 5.

2. Background

2.1 An overview of BSC and performance measurement

During the last decade, a number of methods and frameworks for designing and implementing performance measurement systems have been introduced in the literature.

These systems aim to assist organizations in defining a set of measures that reflect their objectives and assesses their performance appropriately (Farokhi and Roghanian, 2018).

For the past years, BSC has attracted a lot of interest from both researchers and organizations (Hoque, 2014). In recent years, managers and academics have recognized BSC as one of the most important management tools for researchers, professionals and managers (Nudurupati *et al.*, 2010; Wudhikarn, 2016).

The handbook *Certified Six Sigma Green Belt* has offered the BSC as one of the nine key quality approaches over many years by referring to its benefits for controlling the outcomes in an organization's key management areas (Munro *et al.*, 2015). The handbooks of American Society for Quality have also referred to the BSC. It is demonstrated in *The Certified Manager of Quality/Organizational Excellence Handbook* that the key measurements of the BSC should be chosen carefully in each segment because the organizations can only use intelligent and confident decisions to obtain the desired output (Westcott, 2014). In another study, the importance of the BSC in academic research has been addressed (Kádárová *et al.*, 2014).

2.2 BSC and determining quantitative targets

In spite of extensive research on the BSC, few studies have focused their attention on determining quantitative targets. Albertsen and Lueg (2014) have argued that previous research lacks valid constructs for the BSC and places too much emphasis on planning with the BSC and not sufficiently on evaluation and control. In this section, the most relevant studies are presented.

According to Herath *et al.* (2010) although Kaplan and Norton (1992, 1996a, b) suggest that the shortcoming of the BSC in setting targets should be compensated, they do not provide clear guidelines in setting targets and assigning weights to each of them. They have stated that: "Since a scorecard-linked compensation system's effectiveness relies heavily on the targets and weights, consensus over causal linkages is important in implementing a truly successful BSC system." They believed that reaching a consensus on weights and performance measure targets could be a challenging task. Therefore, the authors have presented a method for assigning weights to measures and selecting targets using a collaborative decision-making approach. They draw upon the negotiation analysis literature in order to develop a BSC model to find an optimal or near optimal set of targets and weights that increase the joint value to parties with diverse preferences.

Jain *et al.* (2011) have presented an approach based on data envelopment analysis (DEA) (Charnes *et al.*, 1978) for performance measurement and target setting in manufacturing systems. This approach was applied to two different manufacturing environments. The performance peer groups were identified using DEA and were used to determine performance targets and to guide performance improvement initiatives. These DEA scores were compared with past process modifications leading to the identification of performance changes. DEA also identified targets for specific inputs and outputs. In this study, the authors did not use the BSC framework to assess the manufacturing units and setting quantitative targets but offered a model based on DEA which is capable of measuring the efficiency of manufacturing units (Jain *et al.*, 2011).

Yang *et al.* (2015) suggested that negotiation between managers and performers is one of the most commonly used methods for target setting for KPIs (Yang *et al.*, 2015). They proposed strategy maps and a new method to set targets for KPIs. This method is named "Forecasting Objective Achievement System" for national research institutes. Their proposed method is based on improving decision makers' opinions.

Mendes *et al.* (2014) focused on setting quantitative objectives by decision makers in BSC method. The authors pointed out the difficulties in target setting which could lead to involuntarily biased decisions while setting performance targets. They offered an approach based on sensitivity analysis using Monte Carlo simulation applied to the municipal solid waste management system in Loulé Municipality (Portugal). This method involves two stages: sensitivity analysis of performance indicators to identify those performance indicators with the highest impact on the outcomes of the BSC model and sensitivity analysis of the target values for previously identified performance indicators.

Farokhi and Roghanian (2018) proposed a quantitative methodology for setting targets in the framework of BSC in order to achieve vision and goals. In their research, response surface methodology (RSM) is proposed to find the significant relationships that should be included in the strategy map and the optimal values of performance measures are assessed by using the desirability function-based approach of RSM.

2.3 BSC and simultaneous equations system and goal programming methods

In this section, the most relevant studies are presented.

Daniel and Yusuff (2010) demonstrated a model for selection and ranking of strategic plans in BSC using TOPSIS method and goal programming model.

Fontes *et al.* (2019) used the goal programming model for selecting a set of initiatives in the BSC.

Wudhikarn (2016) suggested a novel hybrid method to improve critical basis deficiencies of the original BSC by integrating three disparate methods: BSC, analytic network process and zero-one goal programming in order to scientifically identify the optimal strategic investment under simulated constraints of the considered organization.

Lin (2015) has stated that future research might investigate the relationship among four perspectives of BSC and company market value by using SES method.

Examining previous research on determining quantitative targets for measurement indicators within the framework of the BSC shows no prior use of the SES and goal programming methods. Thus, a combination of these methods is used in order to determine quantitative desirable values for the performance measures and develop the previous research. Thus, this paper attempts to fill the gap in the literature of BSC method in identifying causal relationships and defining quantitative values for indicators using the SES and GP methods.

2.4 Literature summary

Review of the related literature reveals a gap in mathematical and quantitative modeling between strategic objective values and performance measures and organization goals. In the meantime, a limited number of researchers have gone only so far as to find a qualitative relationship between the organization's goals and performance objective values (Herath *et al.*, 2010; Yang *et al.*, 2015).

In recent years, researchers have offered solutions to further develop the BSC and quantify the concepts used in this model. Some of them have used statistical and system dynamics techniques (Huang, 2009; Valmohammadi and Servati, 2011; Alolah *et al.*, 2014; Wang and Chuang, 2015; Khakbaz and Hajiheydari 2015; Cardoso de Salles *et al.*, 2016; Hu *et al.*, 2016; Park *et al.*, 2017; Peral *et al.*, 2017; Porporato *et al.*, 2017; Soysa *et al.*, 2017) to describe the relationship and dependence among goals and strategy map objectives, while others have utilized multi-criteria decision-making methods (Sharma and Bhagwat, 2007; Oh *et al.*, 2009; Tsai and Chou, 2009; Wu *et al.*, 2009, 2011; Yuan and Chiu, 2009; Dodangeh *et al.*, 2010; Hsu *et al.*, 2011; Seyedhosseini *et al.*, 2011; Hashemkhani Zolfani and Safaei Ghadikolaei, 2013; Rabbani *et al.*, 2014; Quezada and Lopez-Ospina, 2014; Sofiyabadi *et al.*, 2015; Rahimnia and Kargozar, 2016; Kala and Bagri, 2016; Pérez *et al.*, 2017; Dinçer *et al.*, 2017; López-Ospina *et al.*, 2017; Jami Pour *et al.*, 2017; Beheshtinia and Omidi, 2017; Modak *et al.*, 2017; Sayed and Lento, 2018; Quezada *et al.*, 2018) to give weights to the four perspectives and strategic objectives as well as performance measures in order to select the best ones.

However, it still seems that a comprehensive and precise control mechanism or method on the strategy map to make connections between organization goals and quantitative targets for each objective is lacking.

Reviewing previous research often shows improvement areas related to determining connections and giving weights to performance targets as parts of the strategy map. In this way, quantitative models are made and interactions in the objective network of the BSC are partly shown (Koo and Ip, 2004; Tapionos *et al.*, 2005; Thakkar *et al.*, 2007; Rodriguez *et al.*, 2009; Jassbi *et al.*, 2011; Kunz and Schaaf, 2011; Glykas, 2012a, b; Wu, 2012; Lin *et al.*, 2014; Shaik and Abdul-Kader, 2014; Bo *et al.*, 2017; Tizroo *et al.*, 2017).

However, such a solution does not provide a complete description and a precise simulation of the relationship pattern among objectives and performance measures and the organization's goals to determine the desired values for performance targets. Creating a complete simulation model can, on the one hand, provide a more precise description of the relationships within the objective network in the strategy map and, on the other hand, make it possible to monitor and control performance targets and the organization's goals.

Thus, in the literature very little attention has been paid to model the relationship between quantitative values of performance objectives and organization goals to determine their desired values. Obviously, in order to model this relationship, ultimate goals must be defined in quantitative terms. It is also apparent from the review of the literature that no specific study has examined the associations among strategic objectives of BSC method in a SES framework.

Hence, in this paper, to bridge the existing gap, first an attempt is made to identify performance measures that have the most influence on organization vision and desirable goals and to determine their contribution in bringing about the desirable goals. Then, variations in goals by changing each of the measures are estimated and finally, a quantitative model of the relationship between desirable goals and a combination of the most influential performance measures are presented in a BSC method. On the one hand, this model helps managers and organizational decision makers to determine a desirable combination of quantitative values for performance targets in order to achieve a certain degree of success in fulfilling desirable goals in the future. On the other hand, it enables them to have an estimation of the goals that can be fulfilled for any specific combination of target values. In this way, organizations can plan their use of resources and potential as well as actual possibilities in order to achieve the most desirable goals.

3. Proposed approach

As was stated before, having a proper and optimal estimation that illustrates the relationships in a correct and precise manner can play an important role in the explanation and interpretation of the strategy map and in determining the quantitative values of strategic objectives. Thus, it may be argued that the optimization of the performance evaluation system and strategy map without having a correct understanding of the proper and desirable targets is practically futile.

Therefore, the present paper discusses a novel approach for structuring performance measures and setting strategic objective targets in the BSC method by investigating simultaneous equations in a structural equation model and goal programming approach and the expected performance measure values of the financial perspective are used to optimize the measures pertaining to the customer, internal processes, and learning and growth perspectives. Therefore, by quantifying and optimizing strategic target values within the BSC framework, organizations can obtain an optimal combination of their targets in various perspectives of the BSC in order to achieve their goals.

The approach proposed by this research involves the following phases:

(1) designing an initial strategy map in line with the organization's vision and goals;

(2) collection, transformation and analysis of data on performance measures into suitable sets for analysis and modeling;

(3) construction of a structural modeling which constitutes the second phase by using SES approach; and

(4) multi-response optimization of performance measure values considering the relationships in the strategy map and determining desirable values for performance measures in various perspectives of the BSC by using goal programming approach.

The steps used in the proposed method are summarized in Figure 1.

The phases of the proposed model are further explained in the following sections.

3.1 Phase 1: constructing strategy map

Considering the important role of the strategy map in the correct execution of the BSC approach, it is important in the first stage to develop the strategy map based on strategic concepts and organization goals to identify the effective factors on performance evaluation through strategic objectives and measurement indicators and their value levels in a way that leads to a desirable and logical performance of the organization. Niven (2006) suggests holding meetings with senior management teams and taking advantage of expert opinions in order to develop the initial strategy map.

It is important to note that the design of a group may be more challenging considering that members may be willing to defend their own opinions and this can create conflicts. But a group discussion may consider not only a shared vision but also the generation of new insights about the problem under discussion (Montibeller and Belton, 2006).

Accordingly, this problem requires managers to integrate organizational, personal and technical perspectives (Mitroff and Linstone, 1995).

In this research, meetings for designing the strategy map involve managers at both the organizational and specialist levels and the quantitative proposed method enables support for investigating the problem through analytic and data modeling tools (i.e. technical perspectives).

Thus, in the first phase, key strategic objectives, their relationships and the initial strategy map were developed based on the organization's decision makers' opinions in line with the realization of long-term goals. In the next stage, SES approach is introduced. Therefore, factors and target functions in each perspective of the BSC are examined and the independent and dependent variables are defined.

In the next stages which will be elaborated below, considering the obtained relationships in SES, the cause and effect relationships among strategic objectives are tested for identifying the relations that have significant correlations. In this way, the final strategy map is constructed and developed using these cause and effect relationships among the strategic objectives.

It should be noted that the proposed method assumes that the decision makers have agreed upon reasonable strategic objectives, KPIs and hypothesized cause–effect associations in the strategy map while there might be other relationships among the strategic objectives in the strategy map. Therefore, according to decision makers' opinions, the associations among strategic objectives are considered and tested to accept the significant relationships and constructing the final strategy map.

The negotiation approach based on decision makers' opinions and experiences encourages more communication among them and leads to a better knowledge of strategy map, performance measures, quantitative target values and their feasibility.

Indeed, the effects of external factors (i.e. political, economic, social, behavioral, etc.) that may influence the targets are considered in the formulation of long-term goals and strategic objectives.

3.2 Phase 2: data collection and determination of data sets

As was mentioned earlier, the goal in this stage is the collection and transformation of data into suitable sets for analysis and modeling. In this research, strategic objective measures in specific time periods have been surveyed and measured and in fact the data of previous performance measures are used and analyzed.

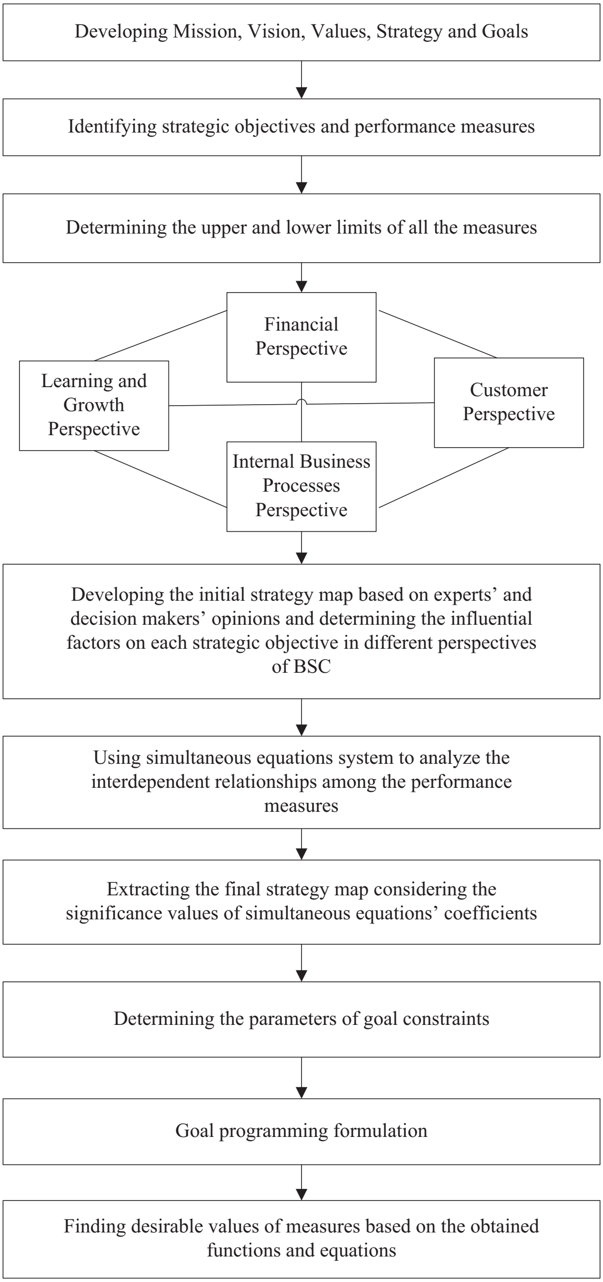

Figure 1.
An overview of the proposed method

3.3 Phase 3: construction of the structural modeling

After utilizing Phase 2 and obtaining performance evaluation system objective data within the framework of the BSC, it is necessary to define the relationships between decision variables and the specified objectives. Therefore, in this research SES approach has been applied.

In fact, by using pervious data of key performance measures and considering the fact that strategic objectives influence strategic objectives of other perspectives from lower to higher perspectives of the strategy map, the performance measures in financial perspective can be taken as dependent variables while performance measures of other perspectives that affect the financial perspective can be considered as independent variables. In the same way, for the next perspective which is that of customer, measures of the customer perspective are taken as dependent variables while lower perspectives (i.e. internal processes, and learning and growth) are used as independent variables. Also the measures of internal processes perspective act as dependent variables and measures of the learning and growth perspective are used as independent variables. In this way, a series of equations between various perspectives of BSC from top to bottom are formed. In the next stage, the relationships obtained in simultaneous equations are checked for significant correlations that form the cause and effect relationships used in developing the final strategy map.

It is necessary to collect more data of KPIs before using SES method. Although the advent of the Information Age has forced organizations' decision makers to provide sufficient information and data for business analysis, the data requirements of the SES-based techniques are met.

Further explanations regarding the SES approach will be presented below.

3.3.1 Simultaneous equations system: a brief description and methods of estimation. A structural model is a set of equations providing the structure of the relations between the variables. Structural equations denote internal variables as the functions of other internal, predetermined and random variables. A structural coefficient displays the direct effect of each independent variable on each dependent variable. Indirect effects could only be found through solving structural equations (Koutsoyiannis, 2001). Since these models express the simultaneous dependency among variables, they are named as "simultaneous equations system." There are several models for estimating simultaneous equations models, e.g., ordinary least squares (OLS), two-stage least squares (2SLS), generalized method of moments, limited information maximum likelihood and three-stage least squares (3SLS) estimation. The 3SLS method is the most common method used for estimating simultaneous equations models because it yields more efficient estimates for the parameters than the two-stage method (2SLS) (Gujarati and Porter, 2008; Greene, 2017).

Indeed, the 3SLS regression analysis provides consistent parameter estimates of models incorporating reciprocal causation and interdependent error terms (Intriligator, 1978). That is, when several equations in a system are interdependent so that the independent variables from one equation appear as the dependent variables in other equations, then OLS estimates will be inconsistent (Calantone and di Benedetto, 1988). Therefore, the structure of the model used for estimating the simultaneous equations sets in this research is 3SLS in terms of operation. The 3SLS method applies the generalized least squares methodology (an extension of 2SLS) to a system of equations which was estimated with the 2SLS method.

3.4 Phase 4: optimization of performance measures' values

In this phase, the optimized values of factors and the defined response variables are determined based on the relationships obtained from simultaneous equations in the previous stage.

In fact, after specifying simultaneous equations between various perspectives of the BSC and by determining a set of quantitative targets expected by the organization which are usually defined as the highest perspective of the BSC, these equations are used to determine quantitative objectives in other perspectives from top to bottom. In other words, at first desirable goals expected by the organization in the financial perspective with known desired values and ranges are taken into consideration and based on the relationships depicted in the strategy map, other related objectives are determined. In fact, since achieving all the objectives in the real world is very difficult and in many cases impossible, goal programming is proposed as a solution. This method intends to solve this problem and to reduce deviation from the goals.

It should be noted that in this study target values of multiple performance measures in various perspectives of the BSC are determined simultaneously. GP method is explained in the following section.

3.4.1 The weighted goal programming (WGP) approach. In early 1961, Charnes and Cooper introduced Goal WGP which is a notable multiple-objective technique. The WGP model does not directly optimize (maximize/minimize) the objectives in contrast to linear programming. Rather, it tries to minimize the deviations of the desired goals from the realized results. In addition, these goals need to be prioritized in a hierarchy of importance. In GP, the so-called deviation variables are used to measure the over and under achievements of goals (Mathirajan and Ramanathan, 2007). This method permits simultaneous solutions for a system with complex objectives. The solution of the problem needs the establishment of the relationships among multiple objectives. One method to deal with multiple criteria is to select one criterion as the primary and the others as secondary. Then, the primary criterion is employed as the optimization objective function, while the secondary criteria are given acceptable minimum or maximum values depending on whether the criteria are maximum or minimum and are treated as problem constraints. In this method, instead of trying to optimize each objective function, the decision maker is asked to determine a realistic goal or target value which has the most desirable value for that function (Carter and Price, 2008).

Decision makers first determine the aspiration level (f_i^*) for every objective, and then try to minimize deviations between the aspiration levels and the achievements as follows:

$$\text{Minimize} = \sum_{i=1}^{m} w_i\left(d_i^- + d_i^+\right),$$

Subject to:

$$f_i(X) + d_i^- - d_i^+ = f_i^*, \quad i = 1, 2, \ldots, m,$$

$$d_i^- \cdot d_i^+ = 0 \quad d_i^+, d_i^- \geqslant 0,$$

where d_i^- and d_i^+ are negative and positive goal deviations, respectively; and w_i is the relative importance of the ith objective.

It is noteworthy that in the proposed approach, first the relationships and associations among strategic objectives are designed according to decision makers' opinions. Then, through the SES method, the relationships suggested by the decision makers have been investigated, tested, validated and finally accepted or rejected. It can be said that the proposed method in this research can complement and improve the decision makers' opinions.

4. The case study

In this section, the application of the stages of the proposed methodology in this research is attempted in a private bank in Iran. This method provides an important insight into the managerial implications of strategic steps for banking performance improvements.

So that decision makers can be provided with the motivation necessary to achieve the strategic objectives, the targets should always be ambitious yet incremental and tangible (Crown, 2003; Dubois, 2012). Therefore, all calculations done in the proposed model for defining the annual targets for each KPI related to the strategic objectives were based on databases that record the organization's history and assist in gaining a more realistic view of what is achievable.

In fact, the historical data of previous performance measures were extracted and analyzed from the results of the scorecards and related KPIs which were based on databases that recorded the bank's history and assisted in gaining a more realistic view of what is achievable.

Considering the necessity of having access to the data of KPIs in order to implement and test the proposed model in the framework of scorecards, the case of research selected to implement the proposed approach is a bank that has already used the BSC methodology to formulate and implement its strategies and also to evaluate performance measures. Therefore, the real data of performance measures were available monthly for the 50 past periods in the four perspectives of the scorecards of the bank under study.

Considering the proposed framework of the research depicted in Figure 1, in the first step, it is required that strategic themes of the bank under study be specified and complied and that its ultimate goals be determined in the strategic statement based on its vision, mission and values. Then, strategic objectives are derived based on the general strategic orientations of the bank under study. In the second step, for the implementation of the strategies, the strategic objectives derived from the first step are divided into four perspectives of BSC and key performance measures for each strategic objective are specified. In the next step, it is necessary to design the strategy map of the bank.

It should be noted that due to the complexity of the data and the time needed for their identification and extraction, expert knowledge and opinion can be of help in the design and development of strategy maps (Parmenter, 2015). Therefore, using the opinions and experiences of the decision makers of the bank under study as well as those of managers and specialists in the field of strategy, the relations between strategic objectives are determined and the initial strategy map is designed based on their opinions and experiences.

Using the opinions and experiences of the managers, specialists and decision makers in the field of strategy and decision makers of the bank under study and based on full discussions and communications with them, the relationships among strategic objectives are determined and the initial strategy map is drawn and analyzed. It should be noted that the suggestions and opinions of the committee of experts consisting of the decision makers of the bank under study (i.e. vice president of banking, financial manager, human resource manager, planning and systems director, information technology manager, service development manager, business process manager, and sales and marketing manager) were integrated to construct the initial strategy map and scorecards of the bank under study.

One of the key features of this bank was that managers had already defined the bank's strategy map, scorecards, strategic objectives, performance indicators and initiatives based on a general BSC framework. Otherwise, it would have been necessary to carry out the complete process from the beginning. Therefore, the strategic objectives had been previously obtained in the strategic planning process by the bank which means that these strategic objectives were specific and valuable for the bank under study. Indeed, all the strategic objectives of the bank were reviewed again by the committee of experts in four different sessions and brainstorming technique was used in all sessions. Furthermore, the Delphi method was utilized to finalize the strategic objectives in different BSC perspectives for developing strategies in the bank under study. After conducting three rounds of Delphi, a consensus was reached by discussion among the members of the committee according to Table I.

Since the aim of this research is not the implementation of the BSC but determining the quantitative values for performance measures, the elaboration of Steps 1 and 2 of the first phase of the proposed study framework is avoided due to space constraints and the final result has been presented in Table I in the form of the BSC of the bank under study.

Table I.
Strategic objectives and performance measures

Strategic theme				
The first choice of target customers through the creation of a real added value to make them loyal				
Perspectives	Strategic objective	Performance measures	Unit	Index
F: financial	Sustainable growth of bank profitability	Return on equity (ROE)	Percentage	F_1
		Economic added value (EVA)	IRR	F_2
		Earnings per share (EPS)	IRR	F_3
C: customer and market	Earning market share	Loans market share	Percentage	C_1
		Deposits market share	Percentage	C_2
	Earning the largest share of currency operations in the banking industry	Foreign exchange market share	Percentage	C_3
	Increasing customer satisfaction and loyalty	Net promoter score (NPS)	Percentage	C_4
	Attracting new customers in target segments	Number of VIP and premier customers	Number	C_5
I: internal business processes	Controlling and reducing costs	Cost-to-income ratio	Percentage	I_1
	Increasing the speed of customer services	Customers' waiting time	Minuets	I_2
	The optimal asset management for sustainable growth	Collecting the debts ratio	Percentage	I_3
	Quick and proper support by the headquarters	Branch satisfaction index from the headquarters	Percentage	I_4
	Leading customers to use electronic channels	The ratio of electronic transactions to total transactions	Percentage	I_5
	Development of products portfolios for different segments of customers	Number of new services	Number	I_6
L: learning and growth	Increasing employee participation	Number of employee suggestions	Number	L_1
	Developing the professional knowledge of bank personnel	Average training hours of personnel	Hours	L_2
	Increasing the organizational commitment of personnel	Employee loyalty index	Percentage	L_3
	Increasing the stability of electronic services	Downtime of electronic services	Percentage	L_4

By considering the strategic themes of the bank under study, the strategic objectives of BSC's different perspectives and the influential factors on the abovementioned strategic themes were determined based on decision makers' opinions. The influential factors on each strategic objective and its corresponding measure in different perspectives are determined according to decision makers' opinions.

The network structure among variables is given in Figure 2. One of the important features of these causal relationships is their synchronization. For example, while L_2, L_3, and L_4 measures affect I_2, simultaneously, I_2, I_5 and I_6 measures influence C_4.

Therefore, there is no direct relationship between C_4 measure and learning and growth perspective measures. These relationships occur indirectly in a set of simultaneous causal equations.

4.1 The structural form of the SES among strategic measures

As shown in Figure 2, according to the opinion of the decision makers and managers of the under study bank, C_1, C_2, C_3, C_5 and F_3 have a significant positive influence on F_1, while I_1

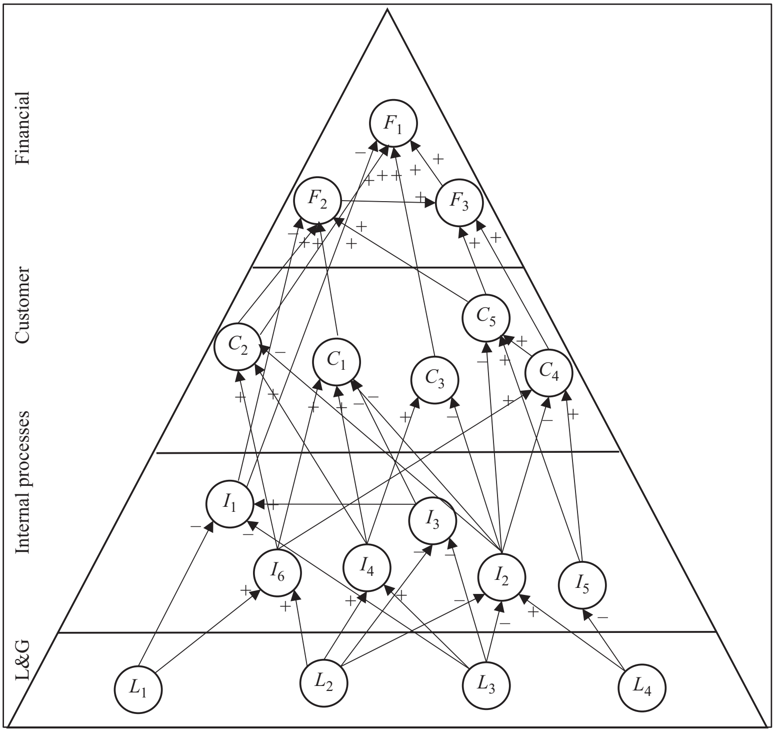

Figure 2.
The network of the structural model

has a significant negative influence on F_1. Therefore, F_1 is selected as the dependent variable and the other objectives related to it are considered as independent variables. An argument similar to that mentioned above is made for the remaining strategic measures.

To determine the significant relationships among strategic measures in different perspectives, SES was employed. It should be noted that all calculations done in the proposed model follow KPIs related to the strategic objectives. In fact, the data of previous performance measures were extracted and analyzed from the results of the scorecards and related KPIs which were based on databases that recorded the bank's history assisted in gaining a more realistic view of what is achievable. Therefore, the historical data for the KPIs were determined from the datasheets that were available for 50 periods.

The influential factors on each strategic objective are at first selected and determined according to specialists' and decision makers' opinions and the significance of input variables on the responses will be re-examined by statistical tools during the modeling phase of the study.

Given the objectives of this research and in order to test the associations among strategic performance measures considered by the managers of the bank under study according to Figure 2, the SES can be constructed as follows:

$$F_1 = \lambda_{1,1} \times F_3 + \lambda_{1,2} \times C_2 + C\lambda_{1,3} \times C_3 + \lambda_{1,4} \times I_1 + \varepsilon_1,$$

$$F_2 = \lambda_{2,1} + \lambda_{2,2} \times C_1 + \lambda_{2,3} \times C_2 + \lambda_{2,4} \times C_5 + \lambda_{2,5} \times I_1 + \varepsilon_2,$$

$$F_3 = \lambda_{3,1} + \lambda_{3,2} \times F_2 + \lambda_{3,3} \times C_4 + \lambda_{3,4} \times C_5 + \varepsilon_3,$$

$$C_1 = \lambda_{4,1} \times I_2 + \lambda_{4,2} \times I_3 + \lambda_{4,3} \times I_4 + \lambda_{4,4} \times I_6 + \varepsilon_4,$$

$$C_2 = \lambda_{5,1} \times I_2 + \lambda_{5,2} \times I_4 + \lambda_{5,3} \times I_6 + \varepsilon_5,$$

$$C_3 = \lambda_{6,1} \times I_2 + \lambda_{6,2} \times I_4 + \varepsilon_6,$$

$$C_4 = \lambda_{7,1} \times I_2 + \lambda_{7,2} \times I_5 + \lambda_{7,3} \times I_6 + \varepsilon_7,$$

$$C_5 = \lambda_{8,1} \times C_4 + \lambda_{8,2} \times I_2 + \lambda_{8,3} \times I_5 + \varepsilon_8,$$

$$I_1 = \lambda_{9,1} \times I_3 + \lambda_{9,2} \times L_1 + \lambda_{9,3} \times L_3 + \varepsilon_9,$$

$$I_2 = \lambda_{10,1} \times L_2 + \lambda_{10,2} \times L_3 + \lambda_{10,3} \times L_4 + \varepsilon_{10},$$

$$I_3 = \lambda_{11,1} \times L_2 + \lambda_{11,2} \times L_3 + \varepsilon_{11},$$

$$I_4 = \lambda_{12,1} \times L_2 + \lambda_{12,2} \times L_3 + \varepsilon_{12},$$

$$I_5 = \lambda_{13,1} \times L_4 + \varepsilon_{13},$$

$$I_6 = \lambda_{14,1} \times L_1 + \lambda_{14,2} \times L_2 + \varepsilon_{14},$$

where F_i, C_i, and I_i are endogenous variables and refer to financial, customer and internal processes measures, respectively; L_i stands for exogenous variables and refers to learning and growth measures which are interdependent and have to be determined jointly; and ε_i stands for random errors.

4.2 Estimation method: conducting the 3SLS analysis

To estimate the SES model, the 3SLS analysis has been conducted for studying potential relations among performance measures in order to identify the correct relations in the BSC and the strategy map framework. The 3SLS analysis estimates a system of structural equations, where equations contain endogenous and exogenous variables (Zellner and Theil, 1962). Typically, the endogenous variables are dependent on other equations in the system.

Considering the KPIs of each strategic objective as data of previous performance measures, the 3SLS analysis has been conducted using EViews 7 for designing, modeling, analyzing and finally extracting the simultaneous equations for all performance measures. The equations have been formulated in EViews as follows:

$$\text{@Inst } L_1 \ L_2 \ L_3 \ L_4,$$

$$I_1 = C(1) + C(2) \times I_3 + C(3) \times L_1 + C(4) \times L_3,$$

$$I_2 = C(5) + C(6) \times L_2 + C(7) \times L_3 + C(8) \times L_4,$$

$$I_3 = C(9) + C(10) \times L_2 + C(11) \times L_3,$$

$$I_4 = C(12) + C(13) \times L_2 + C(14) \times L_3,$$

$$I_5 = C(15) + C(16) \times L_4,$$

$$I_6 = C(17) + C(18) \times L_1 + C(19) \times L_2,$$

$$C_1 = C(20) + C(21) \times I_2 + C(22) \times I_3 + C(23) \times I_4 + C(24) \times I_6,$$

$$C_2 = C(25) + C(26) \times I_2 + C(27) \times I_4 + C(28) \times I_6,$$

$$C_3 = C(29) + C(30) \times I_2 + C(31) \times I_4,$$

$$C_4 = C(32) + C(33) \times I_2 + C(34) \times I_5 + C(35) \times I_6,$$

$$C_5 = C(36) + C(37) \times C_4 + C(38) \times I_2 + C(39) \times I_5,$$

$$F_1 = C(40) + C(41) \times F_3 + C(42) \times C_2 + C(48) \times C_3 + C(44) \times I_1,$$

$$F_2 = C(45) + C(46) \times C_1 + C(47) \times C_2 + C(48) \times C_5 + C(49) \times I_1,$$

$$F_3 = C(50) + C(51) \times F_2 + C(52) \times C_4 + C(53) \times C_5.$$

The significance of each coefficient was determined according to Table II.

It should be noted that Landa coefficients (i.e. $C(7)$, $C(30)$ and $C(47)$) are insignificant at the level of 95 percent since the p-value is more than 0.05.

Therefore, it can be concluded that L_3, I_2, and C_2 in the equations are the variables with no influence on the response variables of I_2, C_3 and F_2, respectively, and have, in fact, a weak effect on predicting I_2, C_3 and F_2. However, the effects of other variables are significant. By removing the effect of these variables, the equations for performance measure are calculated again. The final model consists of 14 equations. The coefficient estimates and statistical results of the equations constituting the structural model of the relationships among measures are given in Table III.

According to Table III, the values of the R^2 for all the responses except I_2 and I_5 are high enough to support a high significance of the models.

The high R^2 value demonstrates that the independent variables included in the 3SLS model are all critical and distinct to the performance of the dependent variable to provide the discriminant validity (Greene, 2017). However, in structural models, in addition to R^2, t-values testing the significance of the parameters should be considered. For degrees of freedom greater than 8 and significance levels over 95 percent, the critical t-value (absolute t-statistic value, either in the positive direction or in the negative direction) is approximately 2 and over (Koutsoyiannis, 2001). In Table III, some R^2 values are low (e.g. R^2 for predicting I_2 and I_5 is 0.656988 and 0.716048, respectively). However, the t-values regarding the parameters are high according to Table IV and are considered significant in displaying the structural relationships.

Table II. The primary results of the estimated coefficients (3SLS)

Landa	Coefficient	SE	*t*-statistic	Prob. (*p*-value)	Landa	Coefficient	SE	*t*-statistic	Prob. (*p*-value)
C(1)	53.10203	7.785793	6.820376	0.0000	*C*(28)	0.229941	0.004061	56.62438	0.0000
C(2)	2.529446	0.290858	8.696501	0.0000	*C*(29)	−0.616653	0.376194	−1.639187	0.0100
C(3)	−0.002160	0.000295	−7.318082	0.0000	*C*(30)	−0.017140	0.011368	−1.507786	**0.1321
C(4)	−0.383032	0.063611	−6.021476	0.0000	*C*(31)	0.519454	0.006274	82.79138	0.0000
C(5)	16.26608	1.086870	14.96599	0.0000	*C*(32)	5.566797	1.694571	3.285077	0.0011
C(6)	−0.039385	0.008333	−4.726417	0.0000	*C*(33)	−0.233588	0.044401	−5.260858	0.0000
C(7)	−0.020638	0.019676	−1.048867	**0.2946	*C*(34)	0.641087	0.019392	33.05979	0.0000
C(8)	127.3289	10.98518	11.59098	0.0000	*C*(35)	0.127219	0.010384	12.25151	0.0000
C(9)	24.70972	0.239004	103.3864	0.0000	*C*(36)	13,632.87	1,414.155	9.640294	0.0000
C(10)	−0.046371	0.002747	−16.87823	0.0000	*C*(37)	163.1417	55.12607	2.959429	0.0032
C(11)	−0.121727	0.006091	−19.98389	0.0000	*C*(38)	−283.8932	40.86513	−6.947077	0.0000
C(12)	10.32574	0.604749	17.07442	0.0000	*C*(39)	47.60706	24.70854	1.926745	0.0500
C(13)	0.306904	0.005629	54.51909	0.0000	*C*(40)	22.68914	2.478185	9.155548	0.0000
C(14)	0.276677	0.010478	26.40675	0.0000	*C*(41)	0.049818	0.000682	73.06980	0.0000
C(15)	50.51276	2.084634	24.23099	0.0000	*C*(42)	0.663780	0.120369	5.514524	0.0000
C(16)	−295.3993	26.08435	−11.32477	0.0000	*C*(43)	0.311568	0.037361	8.339426	0.0000
C(17)	2.829078	0.056099	50.42973	0.0000	*C*(44)	−0.061327	0.023883	−2.567767	0.0105
C(18)	0.005016	2.36E−05	212.3585	0.0000	*C*(45)	1,428.674	74.06479	19.28952	0.0000
C(19)	0.031047	0.000928	33.46343	0.0000	*C*(46)	4.346749	1.713773	2.536363	0.0114
C(20)	4.796859	2.203218	2.177205	0.0298	*C*(47)	2.558847	3.805164	0.672467	**0.5015
C(21)	−0.065061	0.007650	−8.504844	0.0000	*C*(48)	0.008686	0.000564	15.40320	0.0000
C(22)	−0.347886	0.086955	−4.000778	0.0001	*C*(49)	−9.954589	0.706335	−14.09330	0.0000
C(23)	0.349205	0.018646	18.72812	0.0000	*C*(50)	−25.35538	6.397335	−3.963428	0.0001
C(24)	0.080858	0.008058	10.03395	0.0000	*C*(51)	0.052269	0.002611	20.01916	0.0000
C(25)	1.256581	0.122988	10.21713	0.0000	*C*(52)	10.63684	0.817836	13.00608	0.0000
C(26)	−0.046940	0.003987	−11.77253	0.0000	*C*(53)	0.015889	0.002066	7.690932	0.0000
C(27)	0.149804	0.002771	54.06700	0.0000		Determinant residual covariance			10.83095

Note: **Insignificant variable (p-value $\geqslant 0.05$)

Statistical results of the equations (Estimation method: 3SLS)

$I_1 = C(1)+C(2)\times I_3+C(3)\times L_1+C(4)\times L_3$			
Equation (1): $I_1 = 51.8401580579+2.56807216783\times I_3-0.00227634001821\times L_1-0.3652133327\times L_3$			
R^2	0.989465	Adjusted R^2	0.988777
SE of regression	2.515230	Durbin–Watson stat.	2.430406
$I_2 = C(5)+C(6)\times L_2+C(8)\times L_4$			
Equation (2): $I_2 = 15.5580983099-0.0468719272113\times L_2+127.126481738\times L_4$			
R^2	*0.656988*	Adjusted R^2	0.642392
SE of regression	4.179989	Durbin–Watson stat.	1.569015
$I_3 = C(9)+C(10)\times L_2+C(11)\times L_3$			
Equation (3): $I_3 = 24.6838880358-0.0466432049751\times L_2-0.120982939134\times L_3$			
R^2	0.988724	Adjusted R^2	0.988244
SE of regression	0.512776	Durbin–Watson stat.	2.540761
$I_4 = C(12)+C(13)\times L_2+C(14)\times L_3$			
Equation (4): $I_4 = 10.2200574547+0.307723572274\times L_2+0.277472384067\times L_3$			
R^2	0.992620	Adjusted R^2	0.992306
SE of regression	1.785029	Durbin–Watson stat.	1.590759
$I_5 = C(15)+C(16)\times L_4$			
Equation (5): $I_5 = 50.6871620495-298.212291122\times L_4$			
R^2	*0.716048*	Adjusted R^2	0.710132
SE of regression	9.498218	Durbin–Watson stat.	1.557924
$I_6 = C(17)+C(18)\times L_1+C(19)\times L_2$			
Equation (6): $I_6 = 2.83423090353+0.00501383265851\times L_1+0.0310537837021\times L_2$			
R^2	0.999612	Adjusted R^2	0.999595
SE of regression	0.213378	Durbin–Watson stat.	2.039740
$C_1 = C(20)+C(21)\times I_2+C(22)\times I_3+C(23)\times I_4+C(24)\times I_6$			
Equation (7): $C_1 = 6.35665982607-0.0660923652835\times I_2-0.408450816725\times I_3+0.335988546511\times I_4+0.0787665576971\times I_6$			
R^2	0.995884	Adjusted R^2	0.995518
SE of regression	0.630685	Durbin–Watson stat.	2.056127
$C_2 = C(25)+C(26)\times I_2+C(27)\times I_4+C(28)\times I_6$			
Equation (8): $C_2 = 1.2748725745-0.0472180668145\times I_2+0.148895817278\times I_4+0.23148004031\times I_6$			
R^2	0.996802	Adjusted R^2	0.996593
SE of regression	0.306499	Durbin–Watson stat.	1.650545
$C_3 = C(29)+C(31)\times I_4$			
Equation (9): $C_3 = -0.960982871559+0.519434494726\times I_4$			
R^2	0.991755	Adjusted R^2	0.991583
SE of regression	0.968564	Durbin–Watson stat.	1.599415
$C_4 = C(32)+C(33)\times I_2+C(34)\times I_5+C(35)\times I_6$			
Equation (10): $C_4 = 5.47236856369-0.232036895975\times I_2+0.642110119475\times I_5+0.128698935725\times I_6$			
R^2	0.998986	Adjusted R^2	0.998919
SE of regression	0.402935	Durbin–Watson stat.	2.082993

(*continued*)

Table III. Estimation results of 3SLS method

Table III.

$C_5 = C(36)+C(37)\times C_4+C(38)\times I_2+C(39)\times I_5$			
Equation (11): $C_5 = 13341.4440257+179.620630785\times C_4-276.164362215\times I_2+39.4863408386\times I_5$			
R^2	0.997510	Adjusted R^2	0.997348
SE of regression	247.3491	Durbin–Watson stat.	1.457272
$F_1 = C(40)+C(41)\times F_3+C(42)\times C_2+C(43)\times C_3+C(44)\times I_1$			
Equation (12): $F_1 = 23.0651034591+0.0502203877067\times F_3+0.64375074512\times C_2+0.311487683762\times C_3-0.0668983404193\times I_1$			
R^2	0.996884	Adjusted R^2	0.996607
SE of regression	0.645578	Durbin–Watson stat.	2.126774
$F_2 = C(45)+C(46)\times C_1+C(48)\times C_5+C(49)\times I_1$			
Equation (13): $F_2 = 1483.28358884+4.55920651089\times C_1+0.0089138820069\times C_5-10.460938873\times I_1$			
R^2	0.993845	Adjusted R^2	0.993444
SE of regression	22.54287	Durbin–Watson stat.	2.066712
$F_3 = C(50)+C(51)\times F_2+C(52)\times C_4+C(53)\times C_5$			
Equation (14): $F_3 = -25.0803173339+0.0519241688237\times F_2+10.5957788932\times C_4+0.0159694672516\times C_5$			
R^2	0.999752	Adjusted R^2	0.999735
SE of regression	3.303514	Durbin–Watson stat.	1.693462

Table IV. Statistical tests of I_2 and I_5 equations in the model

Equation	Coefficient	SE	t-statistic	Prob.
$I_2 = C(5)+C(6)\times L_2+C(8)\times L_4$				
$C(5)$	15.55810	0.902250	17.24366	0.0000
$C(6)$	−0.046872	0.003823	−12.26075	0.0000
$C(8)$	127.1265	11.00415	11.55259	0.0000
$I_5 = C(15)+C(16)\times L_4$				
$C(15)$	50.68716	2.086644	24.29123	0.0000
$C(16)$	−298.2123	26.12612	−11.41433	0.0000

The final strategy map of the studied bank was drawn again using the factors influencing strategic objectives in each perspective according to Table III.

For example, the main factors affecting the F_1 response are F_3, C_2, C_3 and I_1, while the main factors affecting the F_2 response are C_1, C_5 and I_1 (C_2 is the variable with no influence on the response variables of F_2). According to Table II, I_2 index has no effect on C_3 response. This implies that although the decision makers of the bank believed that the "Customers' waiting time" indicator affects "Foreign exchange market share" indictor, it does not actually impact this indicator. This issue was raised with bank decision makers and specialists and they believed that the "Customers' waiting time" index is very important for customers. Therefore, this index will have a great effect on performance measures of the customer perspective in the BSC.

Thus, in order to achieve the objective, "Increasing the speed of customer service," the bank should define an accurate performance measure in customer and market perspective and also improve the "Customers' waiting time" index.

Other associations are also interpreted in the same way. Therefore, taking into account the other relations according to Table III and the significant associations among factors, the relationships between the strategic objectives of the different perspectives of the BSC for the bank under investigation are illustrated in the form of a strategy map.

As a result of the above steps, all influential and significant factors on strategic objectives of various perspectives of BSC were determined.

By considering the significant associations among the factors in each perspective of BSC of the bank under study, the relations between strategic objectives of BSC were specified in the strategy map. The relationships and associations presented above lead to a better understanding of all the interactions among various strategic objectives of lower perspectives of the BSC to the higher ones, in the bank under investigation, so that these associations can be used for designing strategy map and identification of significant relationships between various strategic objectives. The final strategy map of the studied bank was drawn again using the factors influencing strategic objectives in each perspective.

By identifying and assessing the relationships among strategic objectives in the BSC perspectives, it will be possible to enable dependent strategic objectives by improving the influential strategic objectives. In addition, using this method will help managers and decision makers of the bank to have a more accurate view of the relations between different strategic objectives and to establish a more accurate strategy map.

4.3 Optimization of performance measure values

The purpose of this study is to find the desirable performance measures in order to achieve the organization's expected goals in the uppermost perspective of BSC (i.e. financial perspective). Therefore, after obtaining the final relationships among the strategic objectives according to Equations (1)–(14) and constructing the final strategy map, it is necessary at this stage to find the optimum values of performance measures by considering the desirable values of financial measures in the under study bank.

By investigating the financial measures also defined at the highest perspective of the BSC whose expected and desirable quantity values are usually well known from the perspective of the organizations and their senior managers, the desirable and optimum values of other measures are determined in the bank under study. The results of the investigation of the opinions of the decision makers of the bank with regard to the desirable values of the financial measures have been shown in Table V.

As was noted above, considering the fact that it is necessary to provide conditions for optimizing all values of performance measures or at least to find a desirable range for them, multi-objective optimization can be utilized. Therefore, the WGP method was used to optimize the values of the measures. In other words, the aim is to minimize the deviations (i.e. $d_1^+,\ d_1^-,\ d_2^+,\ d_2^-,\ d_3^+,\ d_3^-$) from every goals of financial perspective measures in order to obtain the desirable values of them ($F_1^*,\ F_2^*,\ F_3^*$). The model of WGP is formulated as follows:

$$\text{Min } Z = W_1 \cdot \left(\frac{d_1^+ + d_1^-}{f_1^- - f_1^+}\right) + W_2 \cdot \left(\frac{d_2^+ + d_2^-}{f_2^- - f_2^+}\right) + W_3 \cdot \left(\frac{d_3^+ + d_3^-}{f_3^- - f_3^+}\right),$$

Subjected to:

$$F_1 + d_1^- - d_1^+ = F_1^*,$$

Performance measures	Index	The desirable goals
Return on equity (ROE)	F_1^*	85
Economic added value (EVA)	F_2^*	1,600
Earnings per share (EPS)	F_3^*	500

Table V. The desirable quantitative performance targets of the financial perspective

$$F_2 + d_2^- - d_2^+ = F_2^*,$$

$$F_3 + d_3^- - d_3^+ = F_3^*,$$

$$F_1 = 23.0651034591 + 0.0502203877067 \times F_3 + 0.64375074512 \times C_2 - 0.311487683762 \times C_3 - 0.0668983404193 \times I_1,$$

$$F_2 = 1483.28358884 + 4.55920651089 \times C_1 + 0.0089138820069 \times C_5 - 10.460938873 \times I_1,$$

$$F_3 = -25.0803173339 + 0.0519241688237 \times F_2 + 10.5957788932 \times C_4 + 0.0159694672516 \times C_5,$$

$$C_1 = 6.35665982607 - 0.0660923652835 \times I_2 - 0.408450816725 \times I_3 + 0.335988546511 \times I_4 + 0.0787665576971 \times I_6,$$

$$C_2 = 1.2748725745 - 0.0472180668145 \times I_2 + 0.148895817278 \times I_4 + 0.23148004031 \times I_6,$$

$$C_3 = -0.960982871559 + 0.519434494726 \times I_4,$$

$$C_4 = 5.47236856369 - 0.232036895975 \times I_2 + 0.642110119475 \times I_5 + 0.128698935725 \times I_6,$$

$$C_5 = 13341.4440257 + 179.620630785 \times C_4 - 276.164362215 \times I_2 + 39.4863408386 \times I_5,$$

$$I_1 = 51.8401580579 + 2.56807216783 \times I_3 - 0.00227634001821 \times L_1 - 0.3652133327 \times L_3,$$

$$I_2 = 15.5580983099 - 0.0468719272113 \times L_2 + 127.126481738 \times L_4,$$

$$I_3 = 24.6838880358 - 0.0466432049751 \times L_2 - 0.120982939134 \times L_3,$$

$$I_4 = 10.2200574547 + 0.307723572274 \times L_2 + 0.277472384067 \times L_3,$$

$$I_5 = 50.6871620495 - 298.212291122 \times L_4,$$

$$I_6 = 2.83423090353 + 0.00501383265851 \times L_1 + 0.0310537837021 \times L_2,$$

$$C_1 \leqslant 100,$$

$$C_2 \leqslant 100,$$

$$C_3 \leqslant 100,$$

$$C_4 \leqslant 100,$$

$$I_4 \leqslant 100,$$

$$I_5 \leqslant 100,$$

$$L_3 \leqslant 100,$$

$$F_1,\ F_1,\ F_1,\ I_1,\ I_2,\ I_3,\ L_2,\ L_4 \geqslant 0,$$

$$C_5, I_6, L_1 : \text{ Positive integer},$$

$$d_1^+,\ d_1^-, d_2^+, d_2^-, d_3^+, d_3^- \geqslant 0,$$

W_k are the weights assigned to each goal ($k=1, 2, 3$); d_k^+, d_k^- denote positive and negative deviations, respectively ($k=1, 2, 3$); and F_k^* the goals for performance measures in the financial perspective ($k=1, 2, 3$).

It is worth noting that the objective function is normalized as below (Jadidi *et al.*, 2015):

$$\text{Min} \sum_k W_k \cdot \left(\frac{d_k^+ + d_k^-}{f_k^- - f_k^+} \right) \quad \text{where } f_k^+ = \left\{ \min f_k(X) \right\},\ f_k^- = \left\{ \max f_k(X) \right\} \quad (k = 1, 2, 3, \ldots).$$

The model was solved by considering equal weights for each goal (i.e. 0.33) by using LINGO software and the following results were obtained according to Table VI. It should be noted that the weight of each performance measure in the financial perspective was the same from the managers' point of view.

Perspective	Performance measures	Unit	Optimum value
Financial	F_1	Percentage	85.00022
	F_2	IRR	1,600
	F_3	IRR	499.9987
Customer and market	C_1	Percentage	42.32555
	C_2	Percentage	34.47075
	C_3	Percentage	50.89846
	C_4	Percentage	22.35687
	C_5	Number	12,844
Internal processes	I_1	Percentage	18.23396
	I_2	Minuets	18.68922
	I_3	Percentage	7.046228
	I_4	Percentage	99.83827
	I_5	Percentage	16.41320
	I_6	Number	83
Learning and growth	L_1	Number	14,472
	L_2	Hours	244.9165
	L_3	Percentage	51.36237
	L_4	Percentage	0.1149314

$d_1^+ = 0.2196093\text{E}{-03}$, $d_1^- = 0.000000$, $d_2^+ = 0.0000$, $d_2^- = 0.0000$, $d_3^+ = 0.0000$, $d_3^- = 0.1341257\text{E}{-02}$

Table VI. The results of solving goal programming formulation

In fact, the performance measure values were determined for customer, internal processes and learning and growth perspectives to achieve performance measures of the financial perspective according to Table VI.

As a result of the above steps, all influential and significant factors on strategic measures of various perspectives of BSC were determined. The effectiveness of these factors has been confirmed by SES method. The strategy map of the bank was drawn again using the factors influencing measures in each perspective of BSC. In fact, by considering the above equations and also the significant associations among the variables, the relations between the strategic objectives of BSC were specified in the strategy map.

By identifying and assessing the relationships among strategic objectives in BSC perspectives, it will be possible to enable dependent strategic objectives by improving influential strategic objectives. In addition, using this method will help managers and decision makers to have a more accurate description of the relations among different strategic objectives and to draw a more accurate strategy map. Also, the performance measure values were determined for customer, internal processes, and learning and growth perspectives to achieve strategic objectives of the financial perspective by using goal programming approach.

Therefore, using the proposed method in this research will help managers and decision makers to have more accurate quantitative values to achieve the goals of the organization.

The method also helped them to have a quantitative assessment of how each target value affects the estimated BSC outcome and the bank's desirable values in the financial perspective, providing them with an appropriate tool for setting targets. They expressed their interest that the results achieved by the application of the proposed method make sense, as they at least could have a solid framework that demonstrates the associations and interactions among strategic performance measures, with consequent additional information about the bank and setting quantitative targets. Also they realized transparent quantitative targets justify a proposed performance's contributions to strategic objectives and serve as the basis for the subsequent performance management and productivity effort.

The main difficulty that this bank had to overcome in the early stages when applying the model was the need to have all the performance measure data for the previous periods available.

5. Conclusion

For the past 20 years, Kaplan and Norton's BSC has attracted a lot of interest from both researchers and organizations and currently a large number of organizations are successfully using BSC (Jalali Naini *et al.*, 2011; Hoque, 2014).

In recent years, managers and academics have recognized BSC as one of the most important management tools (Perramon *et al.*, 2015).

Considering the aforementioned points and despite its many advantages and widespread use as one of the most important managerial tools, the BSC method has some weaknesses and limitations due to which few organizations have managed to implement this model successfully (Chytas *et al.*, 2011; Amado *et al.*, 2012; Grigoroudisn *et al.*, 2012).

In addition, incorrect setting of target values in BSC may lead to involuntarily biased decisions by organizations and may result in the masking of effects, and consequently, in the inappropriate assessment of the true results of planning. In order to prevent this problem, it is necessary to use quantitative methods to complement expert-based methods (Mendes *et al.*, 2014).

The effective and accurate target setting of KPIs is important because it supports decisions, clear performance management direction and as a result enhanced organizational performance. Therefore, absence of a reliable target would result in a lack of feedback to the analysis and decision making.

In fact, one of the challenges in the implementation of the BSC is the problem of determining the relationship pattern between strategic objectives and their influence value and finally their effect on the organization's ultimate and long-term goals.

Target setting for each of the performance measures and determining their relative importance in achieving the organization's desirable goals can also be quite challenging. Organizations must be able to find an optimal combination of quantitative target values in each of the future time frames. Therefore, developing a formula for the transition of the organization from its current state to the desirable state based on organization goals has been tackled in this research. This involves determining the quantitative values of performance targets on the strategy map for future time periods. Hence, a new approach was proposed in order to solve the problems that were mentioned earlier. Based on the suggested framework in this research, after determining strategic objectives and developing an initial strategy map according to decision makers' opinions, SES was used to determine the significance of the relationships among strategic objectives in higher perspectives of the BSC and corresponding strategic objectives in lower perspectives. In other words, significant associations between strategic objectives, obtained through this method, were used to determine cause and effect relationships precisely in the strategy map. In this way, a clearer picture of the relationships between strategic objectives in higher and lower perspectives can be obtained while determining their influence on one another.

Afterward, desirable values for performance measures were determined based on the equations and relationships obtained through SES and were optimized by goal programming method.

This research can be considered as innovative in terms of methodology making use of SES and GP methods in performance evaluation and strategic management issues. This study presented a case study to demonstrate the applicability of the proposed approach. This approach has two main contributions:

(1) The associations among strategic objectives are investigated and obtained in an effective way by conducting the SES for the first time in the framework of BSC. This method analytically identifies the direction and degree of the relations among the objectives. The use of SES has proved to be very beneficial in the process of designing the strategy map during the first stage of modeling in identifying key variables and their causal interrelations.

(2) Considering the performance evaluation structure based on the BSC, quantitative targets have been determined to help in achieving the long-term goals of the organization. This task has been accomplished through a combination of SES, the 3SLS regression analysis and optimization by using goal programming method. Goal programming approach has been applied to achieve multi goals at the same time and has minimized the deviations from goals in the financial perspective.

The proposed method extends the literature on performance management issues based on a confirmative approach providing information regarding an empirical-based revision of managers' opinions about strategy and targets distinguished by their knowledge and experiences.

This approach allows managers and decision makers to test and validate the robustness of their collective beliefs and perceptions providing a method that supports and facilitates decision making.

The findings of this paper can offer a new approach for performance evaluation based on the BSC method which allows the organization's managers to reach a more suitable picture of the relationships structure between organization goals and the objectives within the BSC model to obtain a strategy map of the desired values.

The proposed method can be used by managers to assess proposed KPIs' target, initiatives and projects investment, the process of decision making and the subsequent performance management process. Theoretically, it can also be used as a facilitator to improve theory development in the fields of strategy and organizational performance management.

Indeed, this research contributes to performance management field of study in the following ways:

- A new, practical and analytical approach for identifying the linkages, their direction and the associations of strategy map which facilitates consensus and authorizes the decision makers to construct the accurate strategy map by applying a comprehensive scientific and experimental approach with their knowledge and experiences.
- Considering the performance measurement structure of the BSC, target setting has been done to help in achieving the goals of the organization which allows the decision makers to reach a more accurate picture of the relationships structure among organization goals and the objectives within the BSC perspectives to obtain a strategy map of the desired target values.
- Broadening the scope of the literature can help reconcile the theory and empirical evidence on how organizations set and revise performance targets.
- Decision makers and managers make better decisions when more information is available for them. In this regard, clear targets can contribute to more reliable decisions and help them to set and revise performance targets.

The proposed method can be applied to any organization which uses a BSC framework and assures traceability between their strategic and performance factors for identifying and quantifying the existing relationships between KPIs and setting targets for them.

Despite the fact that most recent researchers have developed and improved the original concept of BSC, there are still some areas of research to improve this model. Future research could focus on the following issues:

(1) Additional studies on the comparison of the results obtained in this research with those that might be obtained by other methods.

(2) The extension of this methodology to a scenario approach in a stochastic target setting in which uncertainty in data and relationships among the strategic objectives is considered.

(3) Applying other optimization methods to determine the quantitative values of performance measures.

(4) In this research, linear equations were significant among variables and were used to determine the relationships. It is suggested that in future studies, nonlinear relations be also investigated to estimate the simultaneous equations in other cases.

(5) Applying other strategic planning and performance evaluation models and comparing the results. It is worth noting that each of these models can be complementary. Therefore, improvement plans should ultimately be developed taking into account a set of these points of view.

(6) In addition, the delay in the effect of independent variables on the performance measures of the system (response variables in the strategy map) and measuring this delay and considering it in the model constitute the areas that need more study and research.

(7) Additional studies on the investigation of cause and effect relationships among the strategic objectives on the basis of four aspects of BSC based on parameters used in the long and short run.

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