

# Organizational performance measurement by a framework integrating BSC and AHP

Organizational  
performance  
measurement

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## Abstract

**Purpose** – Performance measurement, especially at the enterprise level, requires intense consideration of experts and managers in organizations from both theoretical and practical aspects. The purpose of this paper is to investigate the overall organizational performance by developing a performance evaluation model, based on integrating two methodologies of balanced scorecard (BSC) – a multiple perspective plan for performance assessment – and analytic hierarchy process (AHP) – a structured technique for organizing and analyzing complex decisions.

**Design/methodology/approach** – The method was conducted in Isfahan Telecommunications Company (ITC), in 2013. In total, 27 managers of ITC were invited to participate. First, according to overall firm goals, key performance indicators (KPIs) were established with respect to four perspectives of BSC framework. Then pairwise comparisons were done, through standard AHP questionnaires, to determine the preference weights of each indicator and perspective and give precedence to them.

**Findings** – Organizational performance can be measured by the proposed model in a telecommunications industry. According to the adopted method, company KPIs, relative importance of BSC perspectives and performance evaluation of functional areas were identified.

**Practical implications** – This study provides guidance regarding strategies for improving organizational performance beyond the financial perspective.

**Originality/value** – Previous studies illustrate various applications of joint BSC and AHP. However, this study applies the integrated framework throughout an organization in a new application field and shows not only company's features but also telecommunications industry features.

**Keywords** Balanced scorecard, Business performance, Analytic hierarchy process, Telecom company

**Paper type** Research paper

## 1. Introduction

Organizational performance is essential for researchers and managers to evaluate firms and compare them to their competitors. In a nutshell, organizational performance measurement (OPM) is the most important principle in assessing organizations, their actions, and their environments. Organizational performance covers three specific fields of firm results: financial performance (profits, return on assets, return on investment, etc.), market performance (sales, market share, etc.) and shareholder return (total shareholder return, economic value added, etc.) (Neely, 2002).

The performance itself is a firm-specific matter because the strategic choices that a firm makes will determine performance measures which reflect the underlying performance construct. The relationship between measures and performance is influenced by measures which the firm uses internally and how these are embedded into motivation and control systems within the firm; e.g., the firm's own key performance indicators (KPIs). In other words, the internal measurement systems used will influence performance at the individual and organizational level.

Organizations require performance assessments to evaluate the amount of utility and desirability of their activities, especially in complex and dynamic environments.



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Performance measurement is generally defined as the regular measurement of outcomes and results which generates reliable data on the effectiveness and efficiency of programs ([https://eca.state.gov/files/bureau/performance\\_measurement\\_definitions.pdf](https://eca.state.gov/files/bureau/performance_measurement_definitions.pdf)). Harbour (2009) noted that information obtained from performance assessment is used for compensation, stimulating improvement and decision making relating to employees (such as promotion, transfer, dismissal or separation from service), training needs analysis, staff development, research and development and evaluation programs. Waggoner *et al.* (1999) argued that performance measurement in business serves the purposes of monitoring performance, identifying the areas that need attention, enhancing motivation, improving communications and strengthening accountability. It is necessary for the application of performance measurement that a company's tangible and intangible targets are defined in a way that is more appropriate to the requirements and objects of these targets (Smith, 2007).

OPM is essential for continuing management decision making, operational effectiveness, and strategy planning. An OPM is a systematic process for obtaining valid information about the performance of an organization and the factors that affect performance. It differs from other types of evaluations because the assessment focusses on the organization as the primary unit of analysis. Organizations are constantly trying to adapt, survive, perform and influence. However, they are not always successful. Organizations can operate organizational assessments to better understand what they can do or should change to improve their ability to perform. This diagnostic method can help organizations obtain useful data on their performance, identify important factors that support or inhibit their achievement of results and establish themselves with respect to competitors (Neely *et al.*, 2005). An assessment must be able to deliver the overall status of the organization toward the organization's objectives at any time. It should also specify the position of the organization in relation to the environment. In addition, it should represent the effectiveness of all the organization's activities (Olve *et al.*, 1999).

Performance measurement in organizations is highly focussed on financial data for the purposes of coordination and control (Niven, 2008). Venkatraman and Ramanujam (1986) argued that traditional financial measures are insufficient to assess properly the performance of organizations and to provide directions for planned actions. Their assertion is that traditional financial accounting measures can offer confused suggestions for continuous advancement in value and innovation and are beyond the skills and competencies needed by today's organizations. However, well-known financial measures such as return on investment, internal rate of return, net present value and payback period have been demonstrated to be inadequate (Ma, 2014).

The most significant criticism of traditional performance measurements is that they focus on financial measures. With increasing competition in the marketplace, managers need to be aware of other aspects of performance in addition to financial measures. Several researchers using multiple perspectives and various measures for OPM (e.g. Bryant *et al.*, 2004; Neely *et al.*, 2005; Venkatraman and Ramanujam, 1986). Kaplan and Norton (1992) proposed balancing different perspectives based on both the nature of the measures (financial and non-financial) and the object of the measures (internal and external). They named the proposed approach as the balanced scorecard (BSC). The BSC is a multi-dimensional framework that translates a company's strategy into specific measurable objectives. This includes a combination of financial measures, indicating results of actions previously taken and non-financial measures that are guidance for potential performance. While BSC considers several relevant dimensions of organizational performance, it does not formally explain how to weight their

importance in a comprehensive framework. Analytic hierarchy process (AHP) can be a good mechanism to help overcome the limitations of BSC (Bentes *et al.*, 2012).

The focus of the present study is on demonstrating a new real-world application of integrating BSC and AHP theoretical frameworks for OPM; a telecommunications industry case. The current research develops and implements a performance assessment model based on the proposed approach and examines the performance of existing functional areas in Isfahan Telecommunications Company (ITC), a privately held telecommunications company. Previous studies illustrate applications of joint AHP and BSC on hypothetical examples (such as Leung *et al.*, 2006; Clinton *et al.*, 2002), other applications fields (such as Sundharam *et al.*, 2013; Sharma and Bhagwat, 2007; Chiang, 2005; Xu, 2007), only financial sector (Bentes *et al.*, 2012) or theoretical discussion of potential benefits (Jovanovic and Krivokapic, 2008). However, the joint consideration of several functional units along multiple dimensions and several indicators in a telecom company is the originality of the present study and results can assist managers to perform actions beyond the financial perspective only.

The remainder of this paper is organized as follows. In Section 2 a theoretical framework combining BSC and AHP is presented. Section 3 is devoted to research methodology and data, which demonstrates performance ranking of functional units in ITC, taking into consideration the relative degree of importance of four distinct perspectives of organizational performance; the relative degree of preference of performance indicators within each perspective; and the comparative relative performance of five functional units in terms of a combination of all performance indicators. The results of applying AHP in this study are discussed in Section 4. A discussion on the results is presented in Section 5. The paper is concluded in Section 6.

## 2. Theoretical framework

We organize the theoretical framework in two subsections: the BSC and the AHP as a particular tool for multiple criteria decision making (MCDM).

### 2.1 BSC

All the performance measurement models developed after the mid-1980s are more balanced, i.e. models that adopt different perspectives of analysis and manage them in a coordinated way. However, scholars take various approaches to balance performance measurement (see, e.g. Keegan *et al.*, 1989; Neely *et al.*, 2005; Fitzgerald *et al.*, 1991). The BSC is a strategic planning and management system that is used extensively in business and industry, government and nonprofit organizations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications and monitor organization performance against strategic goal (Modell, 2012). The name of BSC is used with the intent to keep score of a set of measures that maintain a balance “between short- and long-term objectives, between financial and non-financial measures, between lagging and leading indicators and between internal and external performance perspectives” (Kaplan and Norton, 1996, p. viii).

Kaplan and Norton (1996, p. 7) describe the innovation of the BSC as follows: “The BSC retains traditional financial measures. But financial measures tell the story of past events, an adequate story for industrial age companies for which investments in long-term capabilities and customer relationships were not critical for success. These financial measures are inadequate, however, for guiding and evaluating the journey that information age companies must make to create future value through investment in customers, suppliers, employees, processes, technology and innovation”. Kaplan and

Norton (1996, p. 2) state that “the Balanced Scorecard translates an organization’s mission and strategy into a comprehensive set of performance measures that provides the framework for strategic measurement and management system.”

The BSC method evaluates companies’ aspects on four dimensions: financial, customer satisfaction, internal processes of how organizations provide conditions for education and continuous development. Among the BSC’s four performance perspectives, one is a traditional financial performance group of items and three others involve non-financial performance measurement indexes: customer, internal business processes and learning and growth. The four perspectives are explained briefly as follows:

- (1) Financial: this perspective typically contains the traditional financial performance measures, which are usually related to profitability. The measurement criteria are generally profit, cash flow, return on investment and return on invested capital and economic value added.
- (2) Customer: according to this perspective, management determines the expected target customers and market segments for operational units and monitors the performance of operational units in these target segments. Some examples of the essential or genetic measures are customer satisfaction, customer retention, new customer acquisition, market position and market share in targeted segments.
- (3) Internal business processes: this perspective focusses on business processes that will have the greatest impact on customers and shareholders satisfaction and achieving financial objectives of an organization. In determining the objectives and measures, a complete internal business-process value chain that can meet current and future needs should then be constructed. A common enterprise internal value chain consists of three main business processes: innovation, operations, and after-sale services.
- (4) Learning and growth: the primary objective of this perspective is providing the infrastructure for achieving the objectives of other three perspectives and for creating long-term growth and improvement through people, systems and organizational procedures. This perspective stresses employee performance measurement, such as employee satisfaction, continuity, training and skills as employee growth is an intangible resource for enterprises that will contribute to business growth. The criteria include costs on training, staff renewal rate, expending on new technologies and lead time for introducing innovation.

The BSC objectives and measures are determined by aligning organizational visions and strategies and are planned to measure organizational performance using the four perspectives. Many companies have mission statements and visions, which are translated into business strategies. Often, these strategies are never fully implemented in the organization. Kaplan and Norton (1996) emphasize considering three basic principles in developing BSC: maintaining cause-and-effect relationships, comprising sufficient performance drivers and keeping a linkage to financial measures. They also stress that the BSC is only a template and must be customized for the specific elements of an organization or industry. Depending on the sector in which a business operates and on the chosen strategy, the number of perspectives can be enlarged or one perspective can be replaced by others. In addition, the BSC concept can be applied to measure, evaluate and guide activities in specific functional areas of a business and even at the individual project level (Kaplan and Norton, 2006).

Since its introduction, BSC has been adopted by many companies as a foundation for strategic management systems. Managers use it to align their businesses to new strategies toward growth opportunities based on more customized, value-adding products and services and away from simply cost reduction (Kaplan and Norton, 2006). However, measuring the performance by the BSC on multiple performance perspectives, other than just a strictly financial standpoint, causes complexity to the measurement of performance, especially in terms of judgment biases and the need to reach some judgment that makes sense of BSC's multiple perspectives and indicators (Ivan, 2002). Leung *et al.* (2006) pointed to the relative abundance of studies regarding the structure of BSC compared to the lack of research on protocols for proper implementation. As Reisinger *et al.* (2003, p. 431) observed, "Without any information to the contrary, managers might likely assume that since the measures are related and have the same primary objective, then they should be equally important." In practice, however, perspectives and indicators do not often have equal importance.

## 2.2 AHP

MCDM refers to making decisions in the presence of multiple, usually conflicting, criteria. There are two groups in MCDM: multi-attribute decision making (MADM) which deals with selection problems and multi objective decision making which deals with design problems. Defining the OPM as quantification of a status, MADM seems closer to be utilized as a tool.

The AHP was developed by Saaty (1977, 1980). It is a popular tool for MADM which permits the relative assessment and prioritization of alternatives. The AHP allows integrating both quantitative and qualitative aspects of decision making, which makes it an efficient method in complex contexts (Saaty, 1990). Since its introduction, AHP has been studied extensively and used in almost all the applications related with MADM in the last 30 years. Besides applying to the finance sector (Steuer and Na, 2003), the AHP has been adopted in education, engineering, government, industry, management, manufacturing, politics, social sciences, sports, economics and medicines (Vaidya and Kumar, 2006; Liberatore and Nydick, 2008; Saaty and Vargas, 2012; Subramanian and Ramanathan, 2012; Ergu *et al.*, 2013). In particular, AHP is applicable in addressing the comparative analysis of performance in business units (Chan and Lynn, 1991; Suwignjo *et al.*, 2000), which is the main objective of the present study. Its wide applicability is due to its simplicity, ease of use and great flexibility.

The AHP uses a hierarchical structure for the decision problem, consisting of an overall goal of a group of alternatives and of a group of criteria which link the alternatives to the goal. The AHP is based on the use of pairwise comparisons, which lead to the elaboration of a ratio scale. Pairwise comparisons are classically carried out by asking how much an alternative  $A_i$  is more valuable than another alternative  $A_j$  with respect to criterion  $C$ . The procedure of the AHP involves six essential steps:

- (1) defining the unstructured problem and stating clearly the objectives and outcomes;
- (2) decomposing the complex problem into a hierarchical structure with decision elements (criteria, sub-criteria and alternatives);
- (3) employing pairwise comparisons among decision elements and forming comparison matrices;
- (4) using the eigenvalue method to estimate the relative weights of the decision elements;

- (5) checking the consistency property of matrices to ensure that the judgments of decision makers are consistent; and
- (6) aggregating the relative weights of decision elements to obtain an overall rating for the alternatives.

Saaty (1980) argues that a nine-point scale (Table I) represents managers' ability to make qualitative distinctions. If an alternative  $A_i$  is preferable to an alternative  $A_j$ , then the value of the comparison scale  $(A_i, A_j) = a_{ij}$  indicates the intensity of relative importance of  $A_i$  over  $A_j$  assigned by the decision maker. By considering all possible pairwise comparisons between alternatives, a matrix  $A$  generates which represents the relative importance  $a_{ij}$  of each element over each other. Higher values of  $a_{ij}$  indicate stronger preference of alternative  $A_i$  over  $A_j$ . The comparison of one pair of alternatives for each decision criterion at a time (instead of a simultaneous comparison involving all alternatives and criteria) reflects the assumption that a decision maker can more easily expose the preferred alternative by analyzing one property of one object at a time. Saaty states an element is as important as itself and taking into account the theorem of reciprocity, if  $i = j$  then  $a_{ij} = 1$  and if  $i \neq j$  then  $a_{ij} = 1/a_{ji}$  (the principle of inverse). On the other hand, alternative  $A_i$  with alternative  $A_j$  should be homogenous and comparable. In other words, the preference of alternative  $A_i$  over alternative  $A_j$  cannot be infinite or zero (the principle of homogeneity). Each alternative can be associated with higher level of hierarchical alternative of the linear dependence and this can be continued up to the highest level (the principle of dependence).

The judgment of decision makers in pairwise comparisons may present inconsistencies when taking into consideration all alternatives simultaneously. For the comparison matrix to be consistent it should be  $a_{ik} = a_{ij} \cdot a_{jk}$ . Saaty has proposed a consistency index (CI) and a consistency ratio (CR) which indicates the degree on which judgments are not coherent. The CI of a matrix of comparisons is given by  $CI = (\lambda_{\max} - n)/(n - 1)$ , where  $\lambda_{\max}$  = maximal eigenvalue. The CR is the ratio of CI to RI, i. e.  $CR = CI/RI$ , where RI is an appropriate random index from the set of numbers each of which is an average random CI derived from 500 randomly reciprocal matrices. Saaty (1977) calculated the RIs shown in Table II. If CR is less than 10 percent, then the matrix can be considered as having an acceptable consistency.

The last step is to synthesize the local priorities across all criteria in order to determine the global priority. The distributive mode adopts an additive aggregation

**Table I.**  
Scale of comparisons  
of the AHP

Intensity of relative importance	Definition	Explanation
1	Equal importance	The two alternatives contribute equally to the objective
3	Moderate importance of one over the other	Experience and judgment slightly favor one over the other
5	Essential or strong importance	Experience and judgment strongly favor one over the other
7	Demonstrated importance	One is judged as much more important than the other
9	Extreme importance	The evidence favoring one over the other is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values	When some compromise is needed

**Source:** Saaty (1980)

with normalization of the sum of the local priorities to unity:  $p_i = \sum w_j \cdot l_{ij}$ , where  $p_i$  is the global priority of the alternative  $A_i$ ,  $l_{ij}$  is the local priority and  $w_j$  is the weight of criterion  $j$ . The ideal mode uses normalization by dividing the score of each alternative only by the score of the best alternative under each criterion.

AHP has been successfully applied in performance measurement studies like the BSC framework (Mei, 2004; Jovanovic and Krivokapic, 2008) and can be used to prioritize and consolidate performance metrics based on multiple criteria. Reisinger *et al.* (2003) proposed AHP as a mechanism for prioritizing organizational measures of BSC. Chan (2006) discusses a case of hospital performance assessment by application of AHP within a BSC framework. Leung *et al.* (2006) applied the AHP and the analytic network process to facilitate the implementation of BSC. Varma *et al.* (2008) applied these tools to evaluate the performance of the supply chain of oil companies. Huang (2009) in his study, proposed an integrated approach for the BSC tool and knowledge-based system using the AHP method. Kim and Kim (2010) determined the elements to be found at the websites of tourism and accommodation firms and their importance degrees according to AHP, based on the BSC. Huang *et al.* (2011) presented the use of the AHP to prioritize all of the measures and strategies in a BSC framework in their study. Bentes *et al.* (2012) demonstrated the applicability of AHP within BSC to evaluate the performance only in the financial department of the firm. Sundharam *et al.* (2013) integrated BSC and AHP to help manufacturing industries for delivering cost effective and high-quality products to customers in a timely manner.

### 3. Methods and data

The present study investigates the performance of five functional units at ITC: the department of financial and logistical and manpower (unit 1), the department of maintenance and operation (unit 2), the department of development and maintenance (unit 3), the management areas and cities (unit 4) and the department of IT management (unit 5). Managers believe that these units are the most strategic areas of the telecommunications company and have the most influence on the performance of the firm.

The basic step in the decision making with the AHP tool is selecting the indicators that the alternatives can be compared to each other, based on them. In order to select KPIs and guide comparative judgments, 27 employees were invited to participate. We avoided selecting respondents at random and we selected those who have sufficient knowledge on alternatives and indicators. They were chiefs and telecommunications experts who have long experience in the company including the principal of financial and economic, deputy director of finance and economy, head of account maintenance, a financial expert, director of information technology, an information technology expert, vice president of marketing and sales, head of sales and marketing, three experts of sales and marketing, four heads of offices, five center heads, a network expert, the main distribution frame expert, head of education office, two persons of departments of education and two bachelors of education. The required data were collected by one of the authors of this paper by talking to the respondents.

<i>n</i>	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Source: Saaty (1977)

**Table II.**  
Random indices

According to experts' opinions, 19 indicators were identified as KPIs (Table III) and as a supplementary work, we prioritized them (see Haddadi and Yaghoobi, 2014). Then a standard AHP questionnaire, in nine-point scale, was designed and distributed among the group. The questionnaire used in this study is composed of three parts: comparison of four BSC perspectives relating to the company, comparison of the indicators relating to each perspective and comparison of the company units with respect to each indicator.

Expert Choice software, that is specialized software for AHP, was used for data analysis in this study. This software not only provides an environment for decision makers to extract the intensity scale of priorities or weigh up the experience, intuition or knowledge of complex information but also in all internal and external factors helps the user to decide (Ishizaka and Labib, 2009). The credibility of information is determined based on the inconsistency rate for paired comparisons. If the inconsistency rate of the paired comparisons matrix is less than 0.1, it will be a valid questionnaire, otherwise, the software helps us to find and fix inconsistent data.

When several individuals provide judgments to AHP, depending on whether the group is assumed to act together as a unit or as separated individuals, these judgments can be directly aggregated (AIJ) or else, just the aggregation of their resulting priorities (AIP) make sense (Forman and Peniwati, 1998). If the group shares common values and goals, usually composing the same organization, AIJ by the geometric mean should be used satisfying the reciprocity principle, implying a synergistic aggregation of individual preferences in such a way the group becomes a new individual and behaves like one. Otherwise, if the group is a set of individuals, usually belonging to different organizations with different agendas, one may take either a geometric mean or an arithmetic mean of their resulting priorities. Groselj and Strin (2012) state the geometric

**Table III.**  
Key performance  
indicators selected  
for the present study

BSC perspectives		Indicator	Definition	Measurement unit
Financial	A	Reducing the establishing costs of each phone line and ADSL	Rial (Iranian currency)	
	B	Reducing the maintenance costs of each phone line and ADSL	Rial (Iranian currency)	
	C	Reducing the percentage of non-collectable	%	
Internal processes	D	Increased monthly revenue per fixed line and ADSL	Rial (Iranian currency)	
	E	The number of sets of fixed telephone and ADSL switches	Telephone number	
	F	Sets of fixed telephone and ADSL	Telephone number	
	G	The number of data ports transfer	Port	
	H	The number of network ports	Port	
	I	Cities having access to the data network	Cardinal number	
	J	Telephone and ADSL fault clearing time	Hour	
Customer	K	Percentage failure of telephone and ADSL	%	
	L	Penetration coefficient of fixed telephone and ADSL	Telephone number	
	M	The success rate of calls	%	
	N	Waiting time for fixed telephone and ADSL	Day	
	O	Pay and benefits of employee performance	Rial (Iranian currency)	
Learning and growth	P	Education and promotion	Hour	
	Q	Time management training	Hour	
	R	Time employee training	Hour	
	S	The number of offers	Cardinal number	



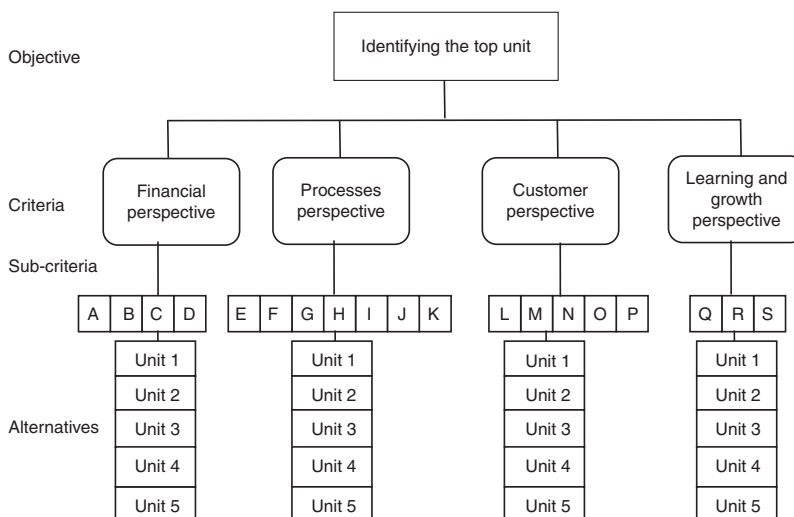
mean method is appropriate when aggregation of individual judgments is used. In this study we calculated the geometric means of the 27 questionnaires and the resulting data were analyzed by the software.

#### 4. Results

Application of AHP to rank the five functional units in ITC involves eight steps as follows:

- (1) Step 1. Entering goals and indicators: in total, 27 participants selected 19 KPIs as in Table III.
- (2) Step 2. Graphical hierarchical representation of the problem: the overall goal is the top level; while indicators and the alternatives are in the next levels. The AHP hierarchical structure of this study appears in Figure 1.
- (3) Step 3. Performing pairwise comparisons: in this study, at first corresponding indicators within each perspective were compared with each other and then the four perspectives were compared. Finally, five functional units (alternatives) were compared in terms of each performance indicator.
- (4) Step 4. Calculating the local normal weight of each indicator: Table IV presents local normalized weights of performance indicators. CR is below the threshold of 0.1, which is acceptable.

In the financial perspective, indicator *D* (increased monthly revenue per fixed line and ADSL) is the most important. Indeed, indicator *D* ranks as almost two times more important than indicator *C* (reducing the percentage of non-collectable) and about three times more important than indicator *B* (reducing the maintenance costs of each phone line and ADSL) and about 12 times more important than indicator *A* (reducing the establishing costs of each phone line and ADSL). In the processes perspective, indicator *J* (telephone and ADSL fault clearing time) ranks as approximately 1.5 times more important than indicator *K* (percentage failure of telephone and ADSL), two times



**Figure 1.**  
AHP structure for  
the present study

**Table IV.**  
Relative importance,  
normalized local and  
global weights and  
consistency ratios at  
the performance  
indicators  
(sub-criteria) level

Financial	A	B	C	D	LW	GW			
A	1	0.171	0.149	0.139	0.044	0.016			
B		1	0.432	0.333	0.171	0.062			
C			1	0.324	0.268	0.105			
D				1	0.517	0.189			
CR	0.08								
Processes	E	F	G	H	I	J	K	LW	GW
E	1	0.254	0.926	2.13	4.67	0.319	0.323	0.102	0.028
F		1	2.92	2.3	0.985	0.444	0.39	0.156	0.043
G			1	2.32	2.39	0.312	0.382	0.089	0.024
H				1	0.435	0.126	0.175	0.039	0.011
I					1	0.129	0.382	0.065	0.018
J						1	1.37	0.313	0.086
K							1	0.235	0.065
CR	0.09								
Customer	L	M	N	O	P	LW	GW		
L	1	0.311	1.26	3.16	3.08	0.37	0.1		
M		1	2.94	5.84	6.31	0.5	0.14		
N			1	7.19	5.48	0.3	0.08		
O				1	2.05	0.08	0.02		
P					1	0.05	0.01		
CR	0.09								
Learning and growth	Q	R	S	LW	GW				
Q	1	2.35	5.86	0.493	0.041				
R		1	4.49	0.311	0.026				
S			1	0.196	0.016				
CR	0.05								

more important than indicator F (sets of fixed telephone and ADSL), almost three times more important than indicator E (the number of sets of fixed telephone and ADSL switches), almost 3.5 times more important than indicator G (the number of data ports transfer), almost five times more important than indicator I (cities having access to the data network) and almost eight times more important than indicator H (the number of network ports). In the customer perspective, indicator M (the success rate of calls) ranks as almost 1.5 times more important than indicator L (penetration coefficient of fixed telephone and ADSL), almost 1.7 times more important than indicator N (waiting time for fixed telephone and ADSL), almost 6.5 times more important than indicator O (pay and benefits of employee performance) and almost ten times more important than indicator P (education and promotion). In the learning and growth perspective, indicator Q (time management training) with relative weight 0.493 ranks as almost 1.5 times more important than indicator R (time employee training) and almost 2.5 times more important than indicator S (the number of offers).

- (5) Step 5. Calculating the normalized weight of each perspective: Table V shows raw and normalized weights, as well as the CR of the  $4 \times 4$  matrix. Note that managers judged that the financial perspective is much more important than any other performance perspectives. In fact, the financial perspective ranks as almost 1.5 times as important as the customer and the processes perspectives and about 4.5 times as important as the learning and growth perspective. As the results show internal processes and customer perspective have almost equal importance.

- (6) Step 6. Determining the global weight of each performance indicator: the global weight shows the indicator's contribution to the overall objective. Calculating the weights in the AHP consists of two parts: relative weights and global weights. The relative weights are the product of paired comparison matrices. While the global weight of each indicator in a hierarchical view is the product of performance indicator local weight times the respective BSC perspective local weight (see Table IV). For example, the global weight of indicator A is  $0.044 \times 0.366 = 0.016$ .
- (7) Step 7. Pairwise comparisons of the performance of each functional area in terms of each performance indicator. Table VI presents the relative evaluation of each functional unit in terms of each KPI, as well as CRs.

Regarding the financial perspective, unit 3 in terms of indicator A (reducing the establishing costs of each phone line and ADSL), unit 4 in terms of indicators B (reducing the maintenance costs of each phone line and ADSL) and D (increased monthly revenue per fixed line and ADSL) and unit 1 in terms of indicator C (reducing the percentage of non-collectable) rank as appreciably more successful. But unit 2 in terms of indicator A and unit 3 in terms of indicators B, C, D rank the least successful. In regard to the processes perspective, unit 3 in terms of indicator E (the number of sets of fixed telephone and ADSL switches), unit 4 in terms of indicators F (sets of fixed

Perspective	Financial	Processes	Customer	Learning and growth	W
Financial	1	1.31	1.58	4.09	0.366
Process		1	1.39	2.37	0.276
Customer			1	5.01	0.274
Learning and growth				1	0.084
CR	0.04				

**Table V.**  
Weights and  
consistency ratio at  
the BSC perspectives  
(criteria) level

Ind.	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	CR
A	0.098	0.049	0.47	0.286	0.097	0.09
B	0.057	0.257	0.049	0.454	0.183	0.08
C	0.566	0.198	0.038	0.114	0.084	0.09
D	0.057	0.268	0.039	0.461	0.176	0.09
E	0.315	0.046	0.485	0.05	0.105	0.09
F	0.074	0.052	0.118	0.547	0.208	0.08
G	0.108	0.071	0.05	0.376	0.395	0.06
H	0.061	0.118	0.27	0.141	0.409	0.05
I	0.102	0.075	0.261	0.147	0.415	0.05
J	0.053	0.282	0.104	0.396	0.166	0.08
K	0.05	0.279	0.111	0.402	0.158	0.07
L	0.208	0.047	0.471	0.171	0.103	0.04
M	0.038	0.435	0.055	0.362	0.111	0.06
N	0.036	0.057	0.487	0.155	0.265	0.08
O	0.139	0.596	0.164	0.033	0.068	0.09
P	0.034	0.293	0.261	0.17	0.241	0.07
Q	0.12	0.344	0.288	0.067	0.18	0.08
R	0.059	0.286	0.28	0.104	0.271	0.03
S	0.273	0.279	0.246	0.1	0.102	0.003

**Table VI.**  
Relative degree of  
success in  
performance  
indicators by each  
functional unit

telephone and ADSL), J (telephone and ADSL fault clearing time), K (percentage failure of telephone and ADSL) and unit 5 in terms of indicators G (the number of data ports transfer), H (the number of network ports), I (cities having access to the data network) rank as more successful. While unit 2 in terms of indicators E, F, I, unit 3 in terms of indicator G and unit 1 in terms of indicators H, J, K rank the least successful. With respect to the customer perspective, unit 3 in terms of indicators L (penetration coefficient of fixed telephone and ADSL), N (waiting time for fixed telephone and ADSL) and unit 2 in terms of indicators O (pay and benefits of employee performance), P (education and promotion) rank considerably better than others. While unit 1 in terms of indicators M (the success rate of calls), N, P, unit 2 in terms of indicator L and unit 4 in terms of indicator O perform the worst. Regarding the learning and growth perspective, unit 2 in terms of indicators Q (time management training), R (time employee training), S (the number of offers) ranks higher than other units. Unit 4 in terms of indicators Q, S and unit 1 in terms of indicator R rank worse. Looking only at the performance of units (functional areas) in terms of specific indicators, it is hard to tell which unit is the best, since a unit can rank well in a given indicator but not in another.

- (8) Step 8. The best-performing unit in each perspective: it derives from a comparison of the vector product between the local weights of the indicators of the business unit (i.e. the achievement of each alternative in each lower-level sub-criteria) and the respective global weights of the indicators. The larger product shows the best overall performance of the functional unit. Table VII indicates the contribution of each unit to the weight of each perspective.

Table VIII summarizes the results. The results show that unit 4 performs the best in three perspectives: finance, processes, and customer. Unit 2 performs better in the learning and growth perspective but its contribution (0.25) to the best performing unit is less than the unit 4 (0.32). Decision makers in the firm clearly considered that the management areas and cities (unit 4) is the most important and is superior taking into account the relative importance of performance perspectives and indicators. Therefore, senior manager of ITC can plan and define projects related to expected indicators with the priority of unit 4 and define staff motivation system (rewards and promotion) to achieve the qualitative and quantitative goals and improve the rankings.

## 5. Discussion

The joint structure of AHP-BSC aims to rank order the organizational units and identify the best performing unit. Then, the company's managers can be aware which functional area is acting best and which requires more attention for performance successes. According to the results, the finance perspective is still more important than other three BSC perspectives from managers and experts' view. The processes, customer and learning and growth perspectives stand, respectively. Company's managers justified the relative importance of the financial perspective, in comparison with others, based on two reasons. First, ITC is a privately held company and its presence in stock and expected shareholders and stakeholders for high earnings per share depends on its revenue stream. Second, the possibility of offering new services, enhancing existing services, and customer satisfaction and perseverance require very good financial status. Although, this result conforms to findings reported by Bentes *et al.* (2012) in a finance sector, however, more researchers such as Sharma and Bhagwat (2007) reported that the customer perspective is perceived as the most important BSC perspective. The authors of the paper also believe the customer perspective is a major contributor to profit growth and achieve success which a business

**Table VII.** Partial contribution of each functional unit to the overall performance objective

for developing should be concentrated on that. According to this fact that in the BSC model, the finance perspective gives information about the current situation but the last three have a role to give insight about the future, the company should implement strategic planning to move toward better future especially in the current competitive world. It is suggested that due to the importance of indicators in each perspective, the top manager directs proper planning especially for the last three perspectives to enhance the performance of the company. For example, regarding the customer perspective, indicators M (the success rate of calls) and L (penetration coefficient of fixed telephone and ADSL) occupied the top priority among other criteria (see Table III). Therefore, the company can increase the success calls by checking and maintaining systems periodically, resolving problems and improving and modernizing them if necessary, using private call center systems in offices and large organizations, using special services and using fax systems and answering machines. In the processes perspective, indicator J (telephone and ADSL fault clearing time) ranks as the most important. This indicator represents the most important measure which can guarantee the stability of services, earning and customer satisfaction. In the learning and growth perspective, indicator Q (time management training) ranks as the most important. Theoretical and practical training of management in the field will have a great impact on guiding the subsets to present the quality of services and enhance productivity. Then the company should invest in training programs.

The procedure presented here to conclude relative weights and rankings of alternatives is sufficiently general to be used in other firms, regardless of industry or country. However, the weights of perspectives and KPIs are important from a managerial view and specific to the case studied. ITC managers stated that by applying this method throughout the company they know how are doing and what needs improving, although the nature of the process is a complicated framework for evaluating the performance of organizational units. They believe that the results of this research are valuable and will be their top priority. The results show not only company features but also telecommunication industry features, country environment and temporal moment.

6. Conclusions

This study developed a performance measurement model by integrating two techniques of BSC and AHP, within a telecommunications company. The method leads to identifying company KPIs, the relative importance of BSC perspectives and the best organizational unit. The results are able to help the organization to evaluate and revise its strategy and generally to adopt modern management approaches in everyday practice. The approach has benefits which we state in the two following paragraphs.

BSC incorporates several perspectives for organizational performance evaluation and enables the company to enhance performance at all levels and across all organizational units. In fact, BSC emphasizes the importance of measuring business

**Table VIII.**  
Final results for  
assessment of the  
best performing  
functional unit

Unit	Finance	Processes	Customer	Learning and growth	Total
Unit 1	0.07	0.02	0.03	0.01	0.13
Unit 2	0.09	0.05	0.08	0.03	0.25
Unit 3	0.02	0.04	0.1	0.02	0.18
Unit 4	0.13	0.1	0.08	0.007	0.32
Unit 5	0.05	0.06	0.05	0.02	0.18
Total	0.36	0.27	0.34	0.087	1

performance from the perspective of strategic implementation, rather than relying solely on financial results. However, senior managers tend to pay far too much attention to the financial dimensions of performance and not enough attention to driving forces behind those results. BSC is designed to offer a comprehensive view of how the enterprise is doing and where it is going. Therefore it will help managers see if any key factors are missing. BSC also reflects operational issues, specifically directing the attention to company's strategy and future direction. By this method, participants of the evaluation process gain insights into the critical areas of the decision process.

AHP provides a comprehensive and rational framework for structuring a decision problem, representing and quantifying its elements, relating those elements to overall goals and evaluating alternative solutions. OPM can be stated as a MADM problem and AHP is effective in addressing the comparative analysis of OPM models. AHP in comparison with other MADM methods, such as Multi Attribute Utility Theory, Simple Multi Attribute Rating Technique, simple additive weighting method, weighted product method and TOPSIS satisfies sub-evaluation, flexible, dynamic and future insight requirements of a performance measurement model (Öztayşi and Uçal, 2009). By providing a hierarchical model, the AHP technique is able to give sub evaluations such as customer performance or processes performance. Another advantage is that subjective qualitative information is transformed into quantitative data which can be used for management decisions. AHP is a viable means for rapid decision making in a team of very different scientists and provides results consistent with those derived through more in-depth and time-consuming approaches as it forces a structured decision making and allows the team to evaluate biases and trends within groups.

In conclusion, we acknowledge some of the general limitations of the method. This method ignores contributions that employees, suppliers, and stakeholders make to help the company achieve its objectives. In other words, the model determines the customer perspective indicators from the management's view instead of the external stakeholders' and customers' views. The role of community and culture in defining the environment in which the company works is ignored. Dynamics of firm and environment are not considered in this approach. External environment dynamics and internal strategy changes are barriers for performance assessment. For instance, the fast trend of scientific changes in organizations is obvious and this requires replacing current personnel with those with new knowledge, particularly in organizations where their activities need highly-skilled staff. In this application, the development priorities are based on experts' opinions and the researchers' comments which, because of their orientations, had a high impact on respondents in interviews. As Bentes *et al.* (2012) argued the risk of self-assessment bias might threaten internal validity and constitutes a limitation for this study. The performance model in this paper was constructed by researchers and therefore the amount of data required and time to obtain them were limitations for the study, due to a long questionnaire and excessive comparisons in AHP.

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