

Jelena Jovanovic
Zdravko Krivokapic

University of Montenegro,
Montenegro

AHP In Implementation Of Balanced Scorecard

Abstract: BSC as a matrix of balanced indicators gives a review of organization activities within four or more perspectives (fields) (finance, users, business processes, learning and development) whereby necessary conditions for development and continual improvement are created. As BSC is essentially a frame for realization of defined strategy in the organization, its implementation asks for an adequate choice of measures – indicators and therefore this paper is oriented towards importance and methodology of the choice of indicators.

This paper particularly emphasizes a possibility of implementation of AHP (Analytic Hierarchy Process) and ANP (Analytic Network Process) as methods of multi-criteria decision-making (MCDM) in implementation of BSC.

Keywords: Balanced Scorecard, AHP (Analytic Hierarchy process), ANP (Analytic Network process)

1. INTRODUCTION

Management of organization in a society with pronounced competition is not a simple process at all, and demands complex knowledge of many different business areas in order to create an environment where organization would develop and focus on success /1/.

Financial indicators themselves that represent traditional indicators of the success of an organization are not sufficient to direct an organization towards realization of the success and sale of its products but it is necessary to find a “balance between the price, quality and purpose of product or service use” /2/.

Thousands of organizations across the world (which is not the case with our country and close surroundings) use BSC for a successful implementation of defined strategy that results from precisely defined mission and vision of an organization. Table 1 presents comparative analysis of an organization before and after BSC implementation so as direct

benefits of its implementation could be observed.

Therefore, strategy of organization is transferred through BSC into clearly defined goals in every perspective, and then for every one of them indicators are defined (measures), target values (limits) and activities in achieving these goals. That process is represented in Figure 1 (through 4 perspectives) by path (**Top-Down**) while BSC certainly has an important role both in **Bottom Up** path where the level of completion of set goals is being evaluated through activities directed towards target values of measuring indicators (measures).

<i>Situation before BSC implementation</i>	<i>Situation after BSC implementation</i>
Unbalanced management	Several different aspects are considered
Accent on financial indicators	Accent on indicators that influence on development
When defining strategy, general and immeasurable goals arise; Strategy determines only a direction of development	Strategic goals turn into measurable goals for every individual; Certain measures are taken in case that goals diverge from the required value
Based on information, it is possible to determine places where planned results were not achieved	Based on indicators, it is possible to foresee future results
It is unclear where certain measures should be taken ; Only result that does not satisfy is known	Information reveal which indicators have the biggest influence on financial results

Table 1. Benefits of BSC /3/ implementation

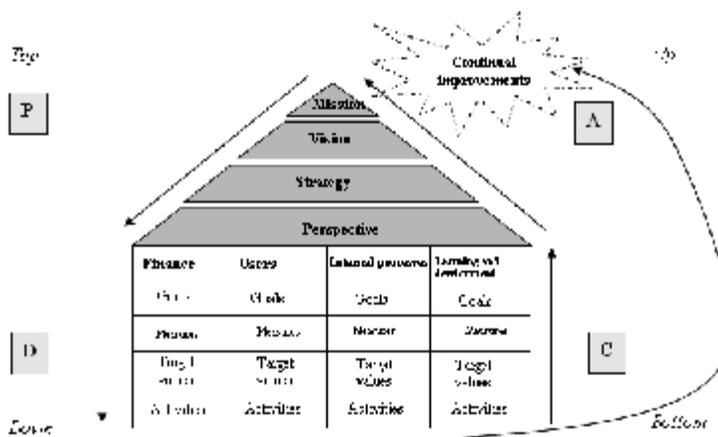


Figure 1. Transfer of mission, vision and strategy through implementation of BSC/4/ /5/

After the strategy of an organization has been clearly and precisely defined and transferred into the system of goals in BSC model it is necessary to perform a proper

2. BSC AND CHOICE OF INDICATORS (MEASURES)

When creating a BSC model after strategy

choice of indicators. That is of great importance considering that by measuring them we establish achievement of goals and in the end, realization of the defined strategy.

and strategic goals have been defined, it is necessary to establish causative relations of strategic goals through perspectives and than consistent with that perform a move down to the level of causative relations of indicators.

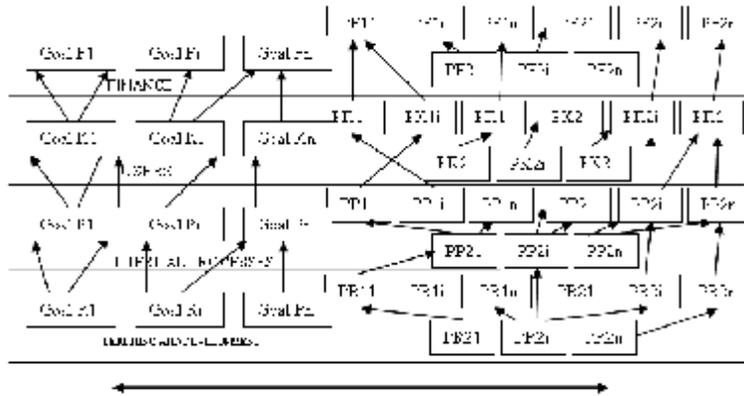


Figure 2. Causative relations of goals and indicators of organizations /6/ /4/ /5/

Development of causative relations represents the most creative part of BSC construction and they can be formed in the following manner:

- ◆ Within one perspective
- ◆ Between non-financial perspectives
- ◆ Between financial and non-financial perspectives

Therefore, strategy transforms into goals that are causatively related so it is possible to successfully implement the strategy only if these relations are well established and transformed into mutual relationship of indicators that result from relationship of goals through perspectives. When defining goals, one must take care that they are mutually consistent because it frequently happens that mutually contradictory goals are set in an organization, which additionally leads to chaotic situation.

Choice of proper indicators is of great importance. On one hand, they must comprise all key processes of the organization, and on the other hand, one must see that their number is not too big because in that case image of the organization becomes unclear and complicated to follow. There is a recommendation that 4-6 indicators should be chosen for every perspective (4 or more). If organizations have a big number of indicators, management uses just a few of them for measurement of the success, or does not use any at all. Choice of proper indicators, which must be oriented towards improvement, is usually a very complex

problem that success of implemented BSC depends on. Robert J Schiller says, "Capability to focus attention on important issues is the most important characteristic of intelligence".

Definition and follow-up of indicators has a significant influence on stimulation and therefore behavior of employees. If influence on behavior is not noticeable, there is a possibility that employees have found a way to achieve target values of indicators, but the organization thereby does not realize planned benefits. What matters is that choice of indicators should be such that they must serve to boost improvement, and not to punish a failure.

Therefore, indicators must focus on areas where managers can influence on efficiency. Special attention should be paid to responsibilities in areas where indicators are chosen. Namely, efficiency is easily questioned in cases when nobody has to undertake responsibility or the distribution of responsibility is unclear.

When determining measures, it is very important to objectively choose a set of indicators that must be well balanced. On one hand, there are indicators that provide information on events that have ended (they are used to measure factual condition – lag indicators) and on the other hand, there are indicators that provide information on trend of changes in the near future (lead indicators).

One of the ways to make an objective choice of indicators is application of the group

multi criteria methodology of decision-making.

3. ROLE OF AHP IN BALANCED SCORECARD IMPLEMENTATION

Methods of multi-criteria analysis and optimization are usually denominated by the acronym MCDM (“Multi Criteria Decision Making”) and they are used in all areas of decision-making. It has also been a practice to use several MCDM methods in solving one problem so as to compare results, because there is no absolutely the best method for all situations and usually it is not easy to verify validity of results. Certainly, methods that have a software support too are most commonly used nowadays.

This paper accents Analytical Hierarchical Process (AHP) well-known MCDM method of scientific analysis and decision-making by calibration of hierarchies whose elements are goals, criteria, sub-criteria and alternatives. Thomas Saaty represented conceptual and mathematical setting up of this model in 1980, and it has been enhanced through numerous scientific papers and doctoral thesis ever since. AHP is reliable and easy to use for decision-making jobs and that is why it has been the most commonly used and the most popular among experts and practitioners. *Expert Choice* is software for support of AHP that is entirely based on its mathematical basis and the most commonly used one.

AHP is based on the following 4 principles (7):

- 1) **Decomposition** – Complex problem is being decomposed into hierarchy where every level comprise many elements that are further decomposed
- 2) **Priority** – implies comparison and evaluation of paired elements from the same level in relation to the element of a higher level

- 3) **Synthesis** – Integration of evaluations per all levels in order to eventually get a list of priority elements of the last level (alternatives)
- 4) **Sensitivity analysis** – Stability of the final result is being additionally verified by testing the best choice by question "what – if" through hierarchical levels

AHP procedure itself is based on 6 basic steps (8):

1. Definition of the problem and clearly set goal and possible alternatives (solutions) of the problem
2. Decomposition of the problem into hierarchical structure with defined criteria, sub-criteria and alternatives
3. Comparison of paired elements from the same level in relation to the element of a higher level
4. Determination of relative weight coefficients of hierarchical elements
5. Testing of evaluation consistency
6. Synthesis of relative weights of decision-making elements in order to get a complete evaluation of significance of alternatives (solutions)

According to the recommendation by Kaplan and Norton, typical BSC should contain 20 – 25 measures. Practice indicates that during BSC implementation there is always an excessive number of required measures (KPI*) and therefore AHP based on the group decision-making can be very successfully applied in this problem.

Application of AHP in Balanced scorecard is represented in Figure 3.

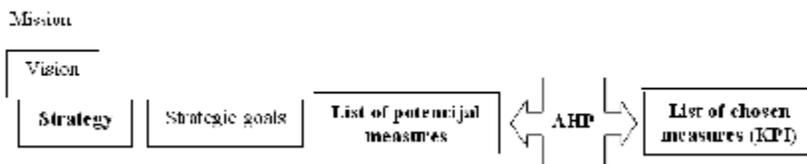


Figure 3. Role of AHP – in BSC implementation

When implementing BSC – primarily it is necessary to clearly define a mission and vision of the organization. Wherefrom strategy that represents a long-term action plan emerges and it must be clearly and precisely described. In order to implement it, it is necessary to

transform it into groups of strategic goals per perspectives and then choose adequate indicators (measures) as well. Creation of one BSC in software package QPR Scorecard that operates in Windows environment is represented in Figure 4.

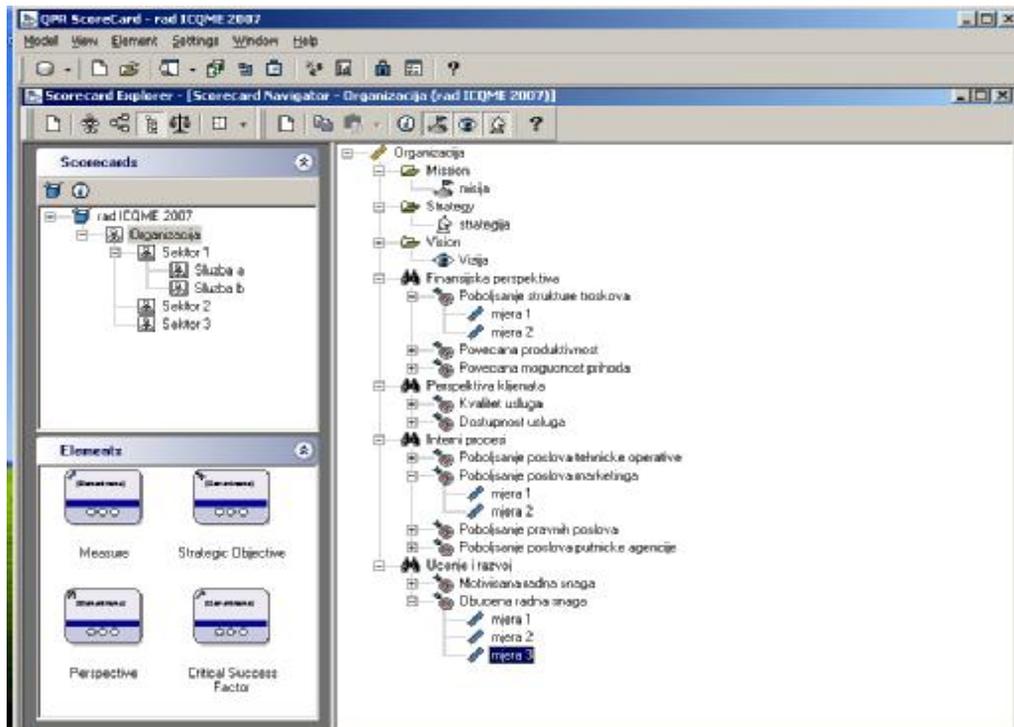


Figure 4. Model of BSC in a fictive organization

From Figure 4 it can be observed that definition of mission, vision and goals per perspectives of one fictive organization has been done in accordance with the procedure shown in Figure 3. Furthermore, procedure of KPI selection goes in the direction of choosing managerial team that shall participate in definition and evaluation of measures in relation to goals of perspectives.

Therefore, according to AHP

methodology, primarily it is necessary to define a hierarchical structure of the problem. As different alternatives are created for every perspective (in this case measures), and managerial teams that participate in evaluation of the model too, therefore it is necessary to define a separate AHP model for every perspective. Layout of AHP model for KPI choice in BSC implementation is represented in Figure 5.

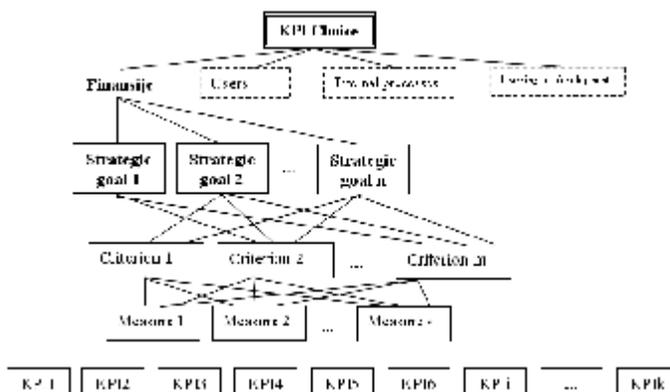


Figure 5. Choice of measures in BSC through application of AHP

In order to provide the most possible objective evaluation by experts from managerial team, introduction of one more additional level in hierarchical structure of AHP has been suggested, that would represent additional criteria in selection of right measures. Criteria relevant for evaluation of measures in relation to goals of perspectives are (9):

1. Relation to strategic goals
2. Simplicity and clearness
3. Organizational correlation
4. Lead-lag indicators
5. Availability (accessibility) of data

Considering previous sub-criteria, managerial team can much more simpler perform both proposal of measures and their evaluation. It is important that all team members unanimously agree on hierarchical structure of the problem and therefore criteria of evaluation and possible alternatives (measures).

Software package Expert Choice is the most appropriate for application of the group AHP so Figure 6 represents a review of evaluation of measures by one managerial team for perspective Learning and development with an example of comparison of criteria in relation to the goal Trained employees.

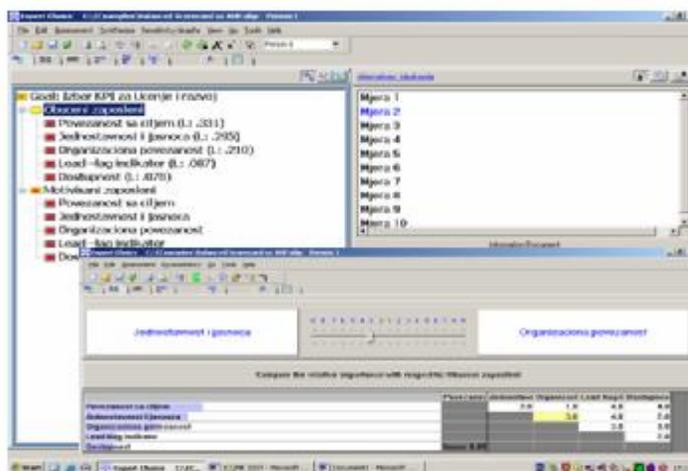


Figure 6. Choice of measures for perspective Learning and development

Managerial team performs evaluation of measures for perspective Learning and development in a way to firstly complete evaluation of strategic goals of this perspective, then criteria for evaluation of measures and then at last, evaluation of measures per criteria. All expert give their evaluations individually, with a possibility to remain indeterminate considering certain issues. In the end, synthesis

4. POSSIBILITY OF ANP APPLICATION IN CHOICE OF BSC INDICATORS

In MCDM theory, rule of mutual independence of elements, i.e. criteria, is generally adopted. However, there are a lot of problems in practice where it is possible to recognize mutual dependence of hierarchical elements. Although many “quasi theories and methods” have been used in problems like this, all the same, Analytic network process (ANP) developed by Saaty in 1996 represents the first mathematical theory that provides a resolution of the problem of interdependency of elements.

AHP characterized by independency of elements from the higher in relation to elements from the lower level, as well as independency of elements from the same level of hierarchy is in its essence just the special case of ANP. Therefore, ANP is a multi-criteria method of establishing significance of alternatives taking into account interdependence of all elements that problem has been decomposed to, but it demands much more complex mathematic apparatus and calculation in relation to AHP.

Super Decisions software package completely supports ANP while the use of Expert Choice software package that is applied at AHP is not possible.

Hierarchical linear structure has neither feedbacks nor interconnectivity of elements within or between the components. Such case is characteristic for the network approach where internal dependency of elements is allowed (within one component), external dependency of elements (between components) as well as the feedback of dependency between components.

of results is performed in order to get a list of measures priority.

When the list of measures priority per all perspectives is given, rank of significance for all perspectives is being chosen in agreement, so as to get a final list of KPI for Balanced scorecard of an organization.

Some basic ideas supported by ANP are (10):

1. ANP is based on the widely practicable AHP theory
2. ANP allows interdependence of elements
3. ANP functions with internal correlation of elements (within one group of elements) as well as with external (between various groups of elements)
4. Network structure of ANP makes possible to define any problem without knowing about hierarchical structure of the problem
5. ANP represents a non-linear structure that deals with sources and cycles and transforms into the hierarchy of linear form with the goal at upper level and alternatives at lower level.
6. ANP supports real problems with accent on groups of elements and their interdependency and not just individual elements
7. ANP employs an idea of the control of hierarchy and control of network dealing with various criteria,

Difference between hierarchical (AHP) and network (ANP) approach is represented in Figure 7(11).

Previous model (ANP) transformed into frameworks of Balanced scorecard gives an entire different view of problematics of choosing KPI in relation to AHP. Figure 8 indicates existence of internal interdependency of elements within the component Strategic goals and within the component Measures.

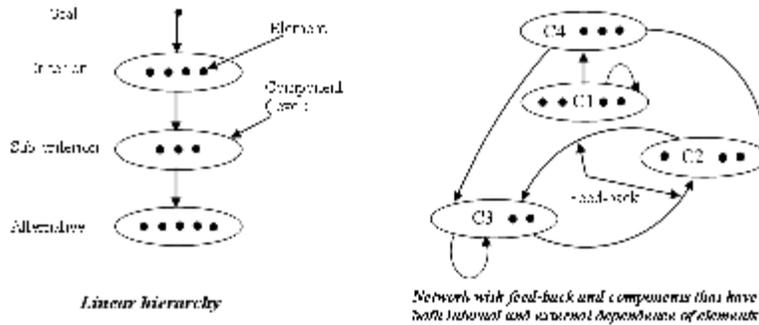


Figure 7. (11) Comparison of hierarchical and network approach

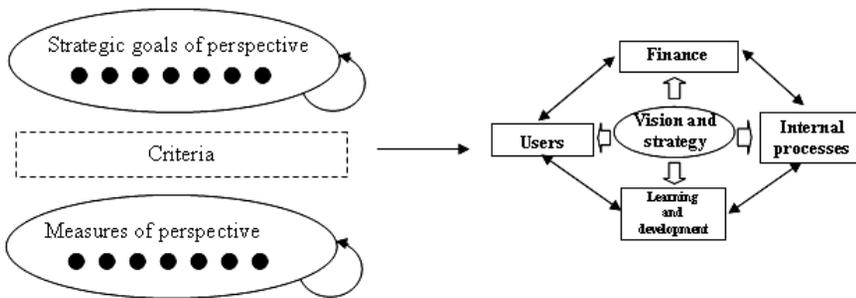


Figure 8. Interdependence of Balanced scorecard elements

Therefore, strategic goals within one perspective are usually interdependent as well as measures within that perspective, which can be additionally confirmed by production of a strategic map during BSC implementation.

Analysis and choice of measures for BSC are additionally complicated if they are considered for an entire Balanced scorecard,

5. CONCLUSION

Application of AHP in selection of KPI at implementation of Balanced scorecard represents a much more simpler apparatus and a much more used method in practice (7,8,...) than ANP although there is an interdependence of elements of hierarchical structure of the model. Particularly, lack of use of both models is "the impossibility to correctly determine validity of both models« /12/

In practice, selection of measures at Balanced scorecard implementation is usually

because in that case, everything starts from a general map by Kaplan and Norton where interdependence of all 4 perspective has been represented. So, in that case, there would be both an internal dependency of elements within one component and external dependency of elements between perspectives and their elements.

done simply through analysis by managerial team without use of any MCDM method. Application of AHP certainly gives much more accurate results because in evaluation of particular elements from one level in relation to the other level in subjective evaluation, correlation of elements is being considered and evaluation of managerial team is being synthesized. With the problem of BSC it is not easy at all to determine the accurate interdependency of elements exactly because of their complex correlation. Through analysis /13/ that was also realized based on AHP and

whose results have been frequently quoted, it had been determined that in practice not even perspectives were entirely balanced but perspective of users had the biggest significance while perspective of learning and

development (satisfaction of employees) took the last place, so consideration of this fact too would represent an additional obstacle in determining correlation of hierarchical elements.

REFERENCES:

- [1] J. Jovanovic, Z. Krivokapic, ... Bsc u profitnim i neprofitnim organizacijama, Nedelja kvaliteta, 2007
- [2] N. Osmanagić Bedenik, *Kontroling abeceda poslovnog uspjeha*, Zagreb 2004.
- [3] Tomislav Leško " Mjerenje performansi informatičkog sektora državne uprave metodom Uravnotežene tablice rezultata
- [4] Paul R. Niven, *BSC Step by step*, John Wiley and Sons, 2002
- [5] Dvorski D., Pokazatelji uspješnosti poslovanja primjenom modela uravnoteženih ciljeva, Mag. rad Zagreb 2005
- [6] Nils -Goran Olve, Jan Roz, Magnus Wetter, *Performance drivers*, A practical guide to using the Balanced Scorecard, Toronto 2004
- [7] Khalid Hafeez, YanBing Zhang, Naila Malak, "Determining key capabilities of a firm using analytic hierarchy process, International journal of production economics, 2001
- [8] Amy H.I. Lee, Wen-Chin Chen, Ching-Jan Chang, "A fuzzy AHP and BSC approach for evaluating performance of IT department in the manufacturing industrz in Taiwan, Science direct, 2006
- [9] George Valiris, Panagiotis Chztas "Making decisions using the balanced scorecard and the simple multi-attribute rating technique, Emerald, 2005
- [10] V. ravi, Ravi Shankar, M.K. Tiwari, *Analyzing alternatives in reverse logistics for end-of-life computers: ANP and balanced scorecard approach*, Computers & Industrial engineering 2005
- [11] Saaty, T.L. Fundamentals of the analytic network process, www.superdecisions.com/~saaty.
- [12] LC. Leung, KC Lam, D.Cao "Implementing the balanced scorecard using the analztic hierarhz process & the analztic network process" Operational research Society Ltd, 2006
- [13] DeWayne, L. Searcy, *Aligning the BSC anda Firms strategy using the Analythic hierarchy process*, 2004
- [14] R. Kaplan D. Northon, *The strategy focused organization*, Harvard Business school 2000
- [15] R. Kaplan D. Northon, *Alignment (Using the BSC to create Corporate synergies*, Harvard Business school 2006
- [16] Paul R. Niven, *BSC step by step for government and non profit agencies*, John Wiley and Sons, 2003

Received: 14.09.2007

Accepted: 19.12.2007

Open for discussion: 1 Year