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Balanced Score Card Model Evaluation: The Case of AD Barska Plovidba

Abstract: *The paper analyses creation of Balanced Scorecard, which includes environmental protection elements in AD Barska Plovidba. Firstly, the paper presents proposed models that include elements of conventional Balanced scorecard, and then we start with proposed models evaluation. In fact, as implementation and evaluation of the model in AD Barska Plovidba takes longer period of time, its evaluation and final choice is based on ISO 14598 and ISO 9126 with use of AHP method. Usually those standards are used for quality evaluation of software products, computer programs and databases inside organisation. After all, they serve as support for their development and acceptance because they provide quality evaluation during the phase when software is not yet implemented inside organistaion, what we assume as very important.*
Keywords: *balanced, score cards, model, evaluation*

1. INTRODUCTION

Balanced scorecard represents strategically direction for measurement and improvement system of organisation's performance.

It is well known that establishers of BSC propose four strategic prospectives (financial, customers, internal process, learning and development), but if we consider that each organisation make business in different environment, we understand that they have different visions and strategies. Hence, it could not be framed generally. This is one of the reason, because of what the general frame of BSC was changing by adding number of prospectives and creation of new scorecards. However, the main objective is establishment of cause and effect objective links and measurements that have to be harmonized and not conflictual. In fact they have to be in balance with adopted organisational strategy. Respecting this, one can consider integration of environmental protection elements in the structure of BSC model.

2. EMS INTEGRATION– IN THE MODEL OF BSC

A large number of books about BSC (2, 3, 4, 5,...) did not pay great attention on possible implemetatition of ecological aspects inside BSC model, neither on analysis of those approches. They focus only on organisation strategic map which includes several ecological objectives inside already established BSC prospective.

The aim of those strategic maps are oriented to " green" customers and financial gains from them. However, there is a number of researches that focus on BSC sustainable concept, more precisely on SBSC (Sustainability BSC). First of all, this concept is oriented to find imrportant organisational strategy that includes ecollogical and social objectives. Those obejectives will lead to economic value throught causel-effect elements link of all prospectives. More precisely, they are oriented to three elements: financial, elogical and social. There is several approaches from different authors concerning BSC sustainable development concept relating to elements

integration.

As this paper is orinted to environmental protection, it is neccassary that those approaches are analysed and in case for integration of objectives and measurements of environmental protection inside BSC model. The main question is which of proposed concepts is mostly appropriate for our organisation and in which way EMS could be integreted effectively in management system because it is clear that in many organisations where EMS is adopted or is adopting, there is insufficiency connection with management system. In this case BSC could be from the great help.

Relating /6/ ecollogical and social aspects could be integreted into BSC in three ways:

1. *Integration of ecological and social aspects in four existing prospectives*

Great number of organisation accept this concept.The reason for this is beacause the concept of sustainable development is not so strict. However, those organisations claim that objectives defined by BSC model include key elements of this problematic.

2. *Adding new ecological/social prospective*

The researchers assume that creation of new (one or more) prospectives give more importance to sustainable development elements. The prospectives' elements have to be linked with not only financial prospectives' elements but also with other prospectives.

In practice the most utilised approach concerns introduction of elements of sustainable development for already established prospective of conventional BSC model, while the approach that is less used concerns addition of prospectives that link objectives because for the majority of the organisations the sustainable development is not relevant. Hence, majority of supporters for this concept argue that strategic relevancy of those elements depend on adding new prospectives /Kaplan i Norton, 5,6,7,8,9, 25,28/.

However, those two concepts are always consider as risky for environmental protection managers, because there is a small number of objectives inside BSC model. This problem is usually neglected because they need to replace other organisational managemet systems.

3. *Creation of derived ecological/social scorecard*

The basics of this approach is that this special scorecard has to be focused in sense of sustainable development. The reason way this approach is rarely used in practice is the fact that oraganisation has to create parallel system to convetional BSC. But what does it mean parallel system? Isn't EMS parallel to ISO 14001, or any other managemnt system that is not completly introduced in BSC parallel system with it?

Scientific researches are not explicitly oriented on creation of efficient and effective scorecards nor to analyse the way of their connection with convetional scorecards. Rarely, in literature some resources present examples of practical introduction of SBSC maps inside organisation /9,25,26,27/.

3. BSC MODELS WITH ENVIRONMENTAL PROTECTION ELEMENTS IN AD BARSKA PLOVIDBA

The AD Barska plovidba created BSC model for managing which is releted to entire organisational business parally with organisational strategy and only in one part they include environmental protection elements because AD Barska plovidba organisation has implemented system for continual conduction of Safety Management System (SMS), which is based on ISM Cod. It is developped by IMO as an obligatory regulation for all companies that make business in internationl marine traffic. We should underline that this organisation is in preparation period for ISO 14001 standard implementation.

Available procedures /14 i 15/ in AD Barska plovidba concern in majority environmental protection in boat processes. The literatute rivew in the area of environmental protection performance (9,10, 16, 17,20,21,22,23,24,25) creates list of objectives and measures following prospectives concerning ECO-BSC which is harmonized with oganisation's environmental protection manager. In order to respect basic principal of QMS that is also requested by BSC establishers, they have to focus on employees involvement. In fact, the list should be analyzed additionally with employees. More precisely,

three teams with three memebers are created for each prespective of Eco-BSC and using AHP tools for group multi-creterium decision making. Firstly, they realise the analysis and then objectives evaluation and mesures importance /18/. Following this approach, the begining of list relating objectives and measures will not change, apart that it receives rang list of their importance what is of significant importance concerning the link to Eco BSC with convetational BSC model.

ECO – BSC model

Figure 1 presents ECO-BSC model apperance with strategic map for whole organisation AD Barska plovidba in software package QPR scorecard.

ECO-BSC can function independently and connect to a certain level ecological activities with management system but as independent entity. Generally its purpose as, independent entity, is performance measurements and their improvements.

To avoid creation of parallel management system with divergent objective, there is a need

for key elements (objectives and measures). ECO-BSC could be introduced in conventional BSC in following ways:

1. adding one or more ECO-BSC objectives to convetional BSC prespective
2. create additional prospective (ECO) with key objectives of ECO-BSC

Likewise, we will have only one ECO-BSC that would be followed by environmental protecton manager and convetional BSC model in which one part of objective value would be calculated basing on ECO-BSC that would be followed by top managers.

Appearance of convetional BSC with objectives that would be implemented in ECO-BSC with arleady established conventional BSC and make them compatible to facilitate parallel utalisation of two systems in frame of one organisation is presented in the figure 2.
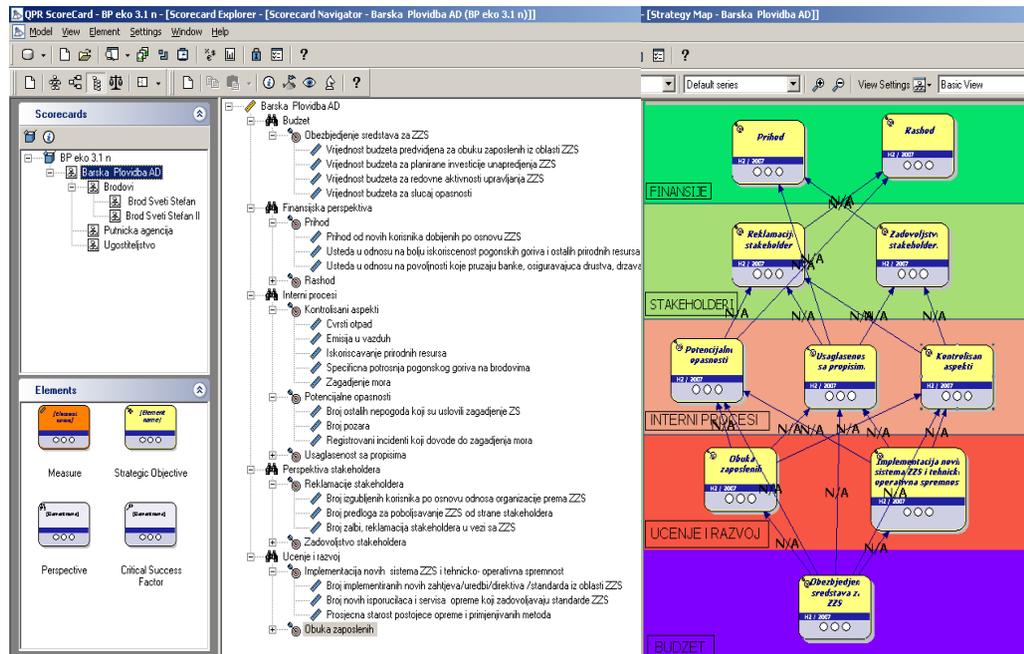

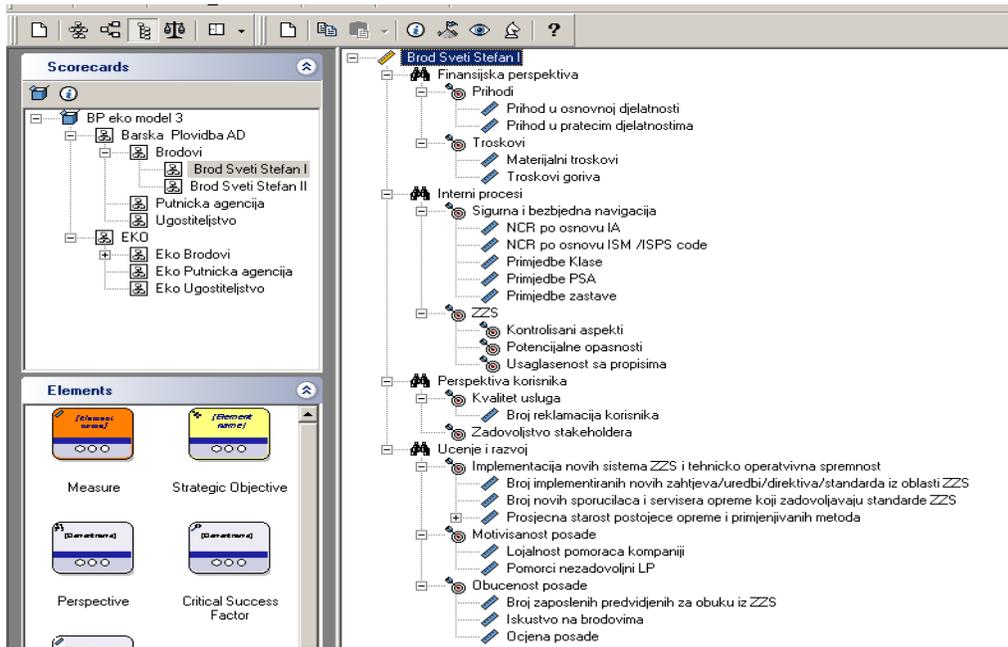*Figure 1. ECO - BSC model with strategic map apperance*

Figure2. Appearance of conventional BSC linked to Eco BSC with implemetation of objectives into already established prospectives (Model 1)
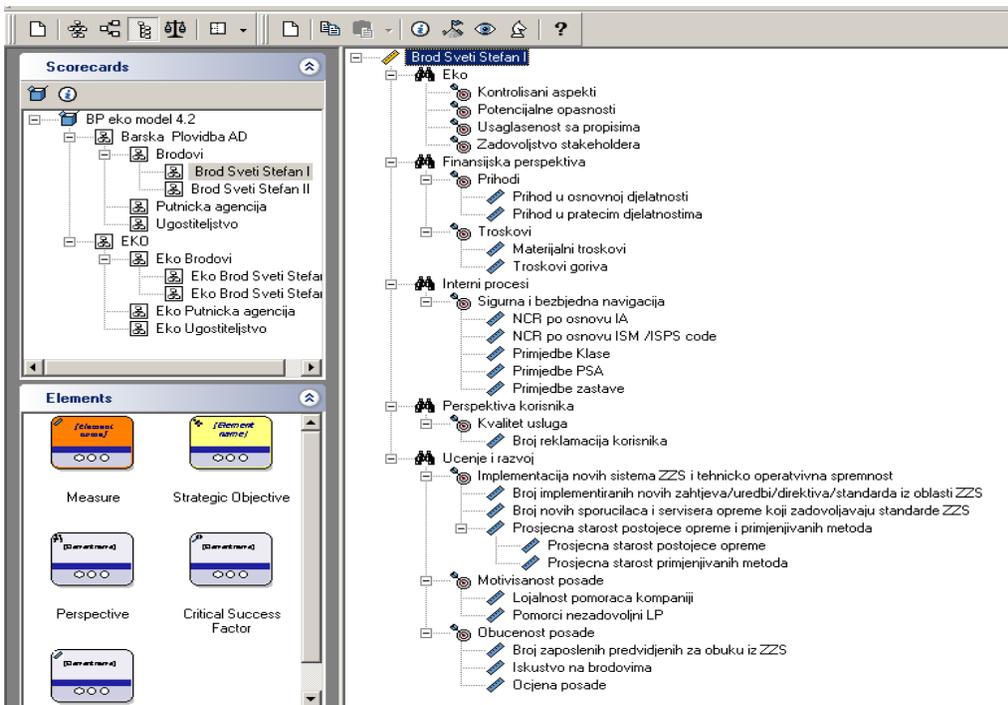

Figure 3. Appearance of convetional BSC linked with ECO BSC creation of new prospective (Model 2)

Previously, we presented network connection of convetional and ECO BSC on the organisational entity Boat Sveti Stefan I. This approach is adopted also for the rest of the organisation's entity, including also coorporate model. In this way, organisation realises complete connection on organisational level. Secon approach concerns that all objectives evaluated as important for convetional BSC, in previous model, would be connected in one prospective, so called ECO. In this way, we create model 2 that presents convetional networking ECO BSC, how it is presented for organisational entity Boat Sveti Stefan. This approach is presented in figure 2.

Model 2 links ECO BSC and convetional BSC. It also includes the frame of convetional BSC, for each scorecard, creates one prospective called ECO that includes all ECO BSC objectives that are neccessary inside convetional BSC.

We will analyse with great details both models which link ECO BSC with convetional BSC, in order to choice the most appropriate model for Ad Barska plovidba organisation from their strategic aspect. It will include also elements of environmenetal protection. To respect completely approcah that is proposed by literature concerning environmental protection introduction inside convetional BSC, we should create two more models:

1. Model 3 which corresponds to implemetation of environmetal protection elements inside already established BSC prospectives-this approach corresponds to model 1 but without additional ECO BSC and it is presented in the figure 4

Model 4 that corresponds to implementation approach of environmental protection elements inside new created prospective called ECO-this approach corresponds to model 2 without additional ECO BSC and it is presented in figure 5.
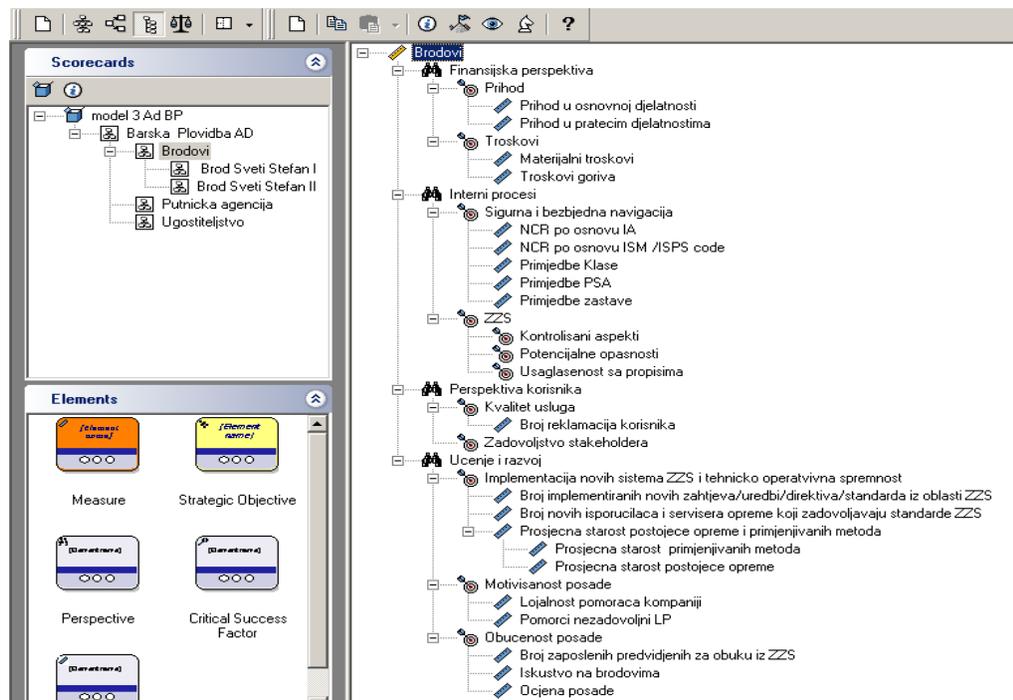

Figure 4. Model 3-include elements of environmental protection that are already established inside convetional BSC without creation of separate ECO BSC
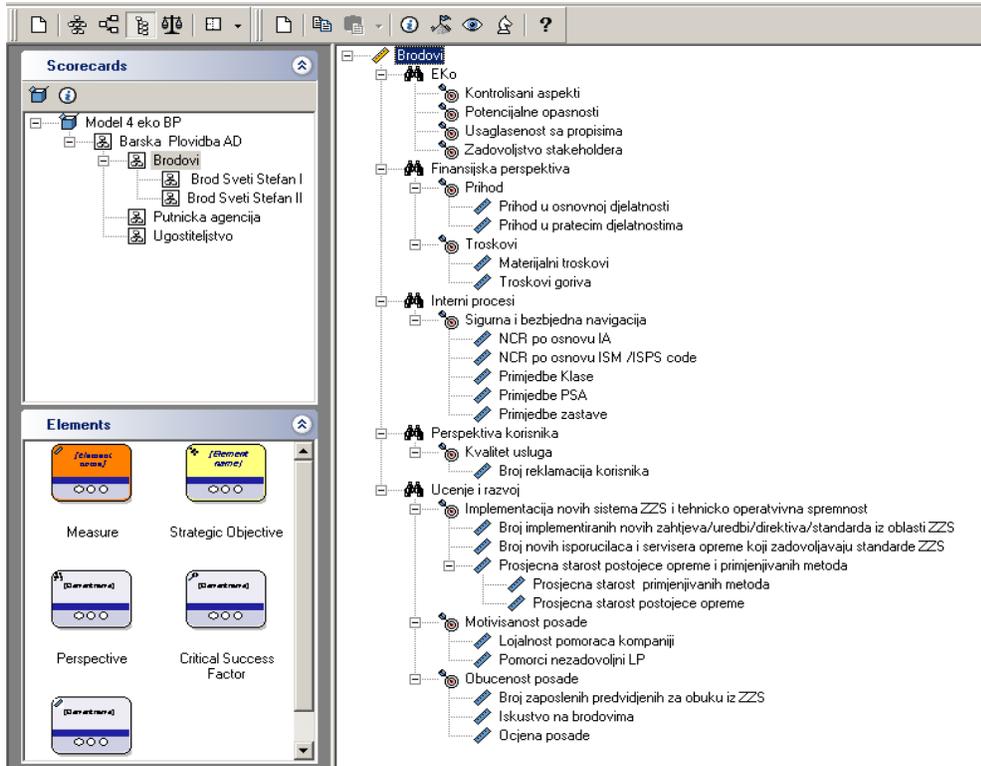
***Figure 5. Model 4-Introduction of environmental protection elements inside BSC by creating
additional prospective without separate ECO BSC***

4. MODEL EVALUATION

Even if great number of standards are available concerning evaluation of quality software products, it should be taken in mind spcificty of model, so in this research we propose ISO IEC 9126 and ISO 14598 standards.

The purpose of quality software evaluation is to propose development support and accepte software products to reach custemer needs.

ISO 9126 standard' request is used as a guideline for quality software testing and includes 4 following entitis

1.   ISO-IEC 9126-1:2001 Software engineering – Product quality – Part 1: Quality model
2.   ISO-IEC TR 9126-2:2003 Software engineering – Product quality – Part 2: External metrics
3.   ISO-IEC TR 9126-3:2003 Software engineering – Product quality – Part 3: Internal metrics
4.   ISO-IEC TR 9126-4:2004 Software engineering – Product quality – Part 4: Quality in use metrics

Concerning the first part of the ISO 9126 standard- Model 1 Software Quality, we should underline that it includes two models that are used for software quality evaluation:

1. Internal and external quality model
2. Quality in use metrics

Internal and esternal quality model

First part (internal and external quality models) is defined with 6 basic criterium that are further divided into 27 sub-criterium as it is presented in figure 6 (1, 11,12,30).
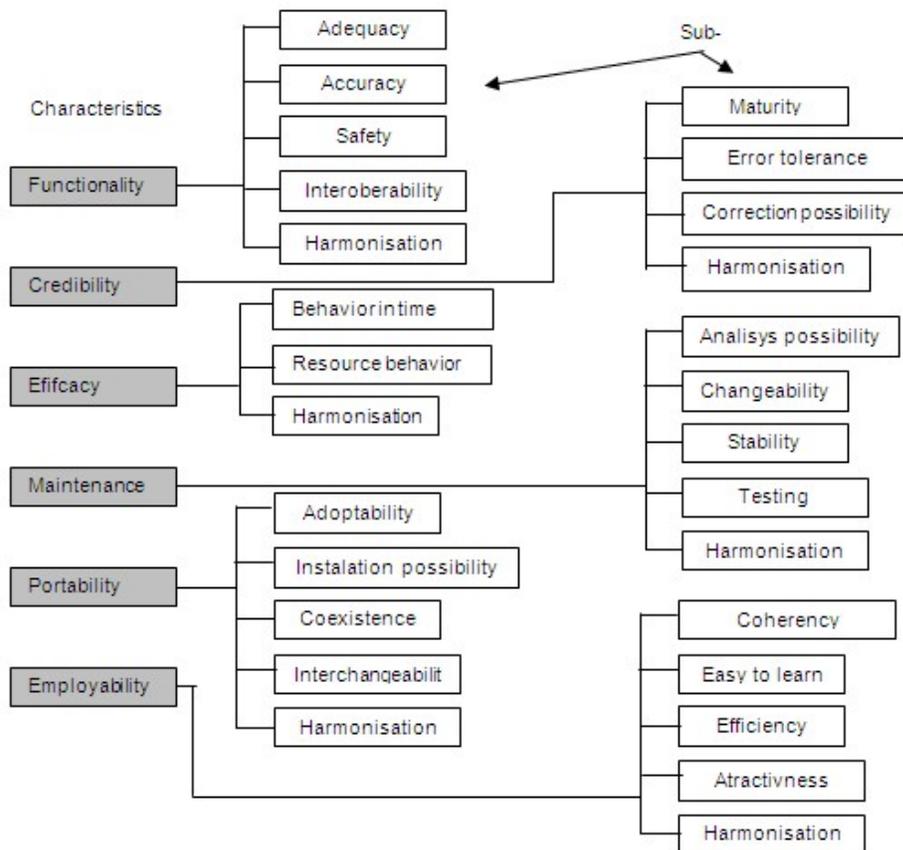
Figure 6. Software evaluation with internal and external aspects

Model of internal and external quality evaluation is completely adopted for all types of software, computer programs as well as databases inside organisation. So, each criterium is defined trough 4-5 sub-criterium that decribe better their main purpuse.

In seria ISO 9126 standard, there is two technical standards ISO 9126-2 for external measures and ISO 9126-3 for internal measures that propose description of external and internal measures, more precisely description of attributes for each quality sub-criterium.

A part of ISO9126 standard, ISO organisation has delivered series of ISO 14598 standard for Software Product evaluation as well as guideline for ISO 9126 standard utilisation (11).

So, Standard ISO/IEC 9126 defines general aim of quality model, quality criterium and gives examples of meausres for ISO –IEC 14598. It gives directions and assignment of activities inside software products process valuetion.

Series of ISO – IEC 14598 Standard (13) propose directions and requests that should be realised inside evaluation process for three different situations:

- Development
- Adoption
- Independent Evaluation

Standard correlation ISO IEC 9126 and ISO IEC 14598 is best described with figure 7 (30)
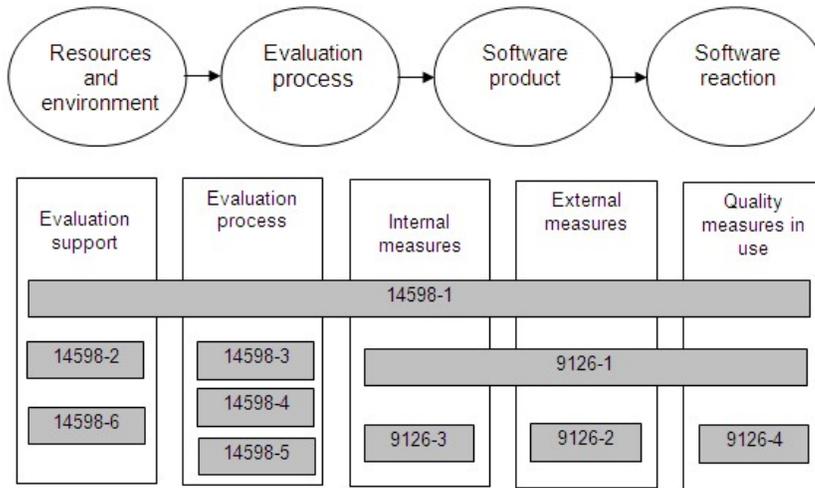
Figure 7. Links between standrd ISO IEC 9126 and ISO IEC 14598

We can notice forom the figuer above that ISO 14598-1 standard covers whole evaluation software product process in sense of valuation approach, but it is supported by quality model which is defined by ISO 9126-1 standard concerning criterium that should be valueted.

Evaluation software approach is presented by ISO 14598-1 standard and it underlines that software quality evaluation needs after all defined request for evaluation, specifity, design and that evaluation should be realised as it is presented in the figure 8 (13).
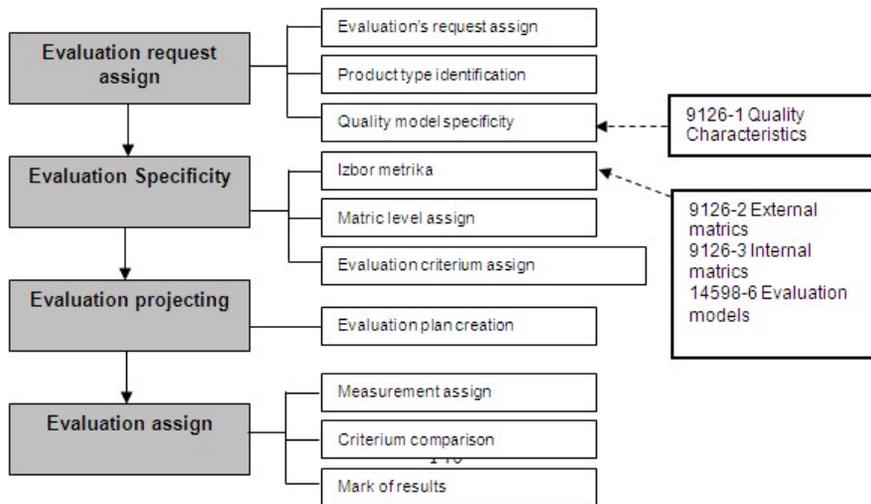

Figure 8. Evaluation process

Evaluation process is presented through four key phases:
- Request valuation definition
- Valuation Specificity
- Valuation Planning
- Valuation Realisation

Each sub-phase or activity is devolopped in detail as well as standards that improve their realisation.

Previously, described evaluation model

process is compatible with MCDM methods of decision making in which we have evaluated elements of one level relating elements of superior levels. This methods propose messages for level definition of certain measures and final mark of all proposed alternatives. It is realised by solutions sythensis with obligatory mark of consistency.

Hence, with MCDM method choice which is compatible with software product evaluation process (ISO 14598) with defined model criterium and sub-criterium in way it is decribed by ISO 9126, organisation could successfuly realised quality evaluation for any product software type.

Reference for standard used for evaluation created BSC model in this research is ISO IEC 9126 which includes software product evaluation throught assesment of internal and external quality model and quality model in use matrics.

Evaluation of four BSC models will be realised using interanal and external quality model based on 6 criterium and their 27 sub-criterium. Evaluation of quality software in use matrics is envisaged for further research after implemetation of favorised BSC model in AD Barska plovidba.

ISO 9126 Standard allows dispence of certain criterium and sub-criterium in evaluation process with justify explanation. However, to realise more precise sub-criterium definition it is neccessary to realise technical analysis of ISO 9126'2 and ISO 9126'3 standards that recommend relative external and internal measures. In fact ISO 9126-2 and ISO 9126-3 standards propose for each quality sub-crietrium internal and external measures that additionally explain their importance and signification but do not oblige on utilisation of ISO 9126-1 standard, since each software product is specify by design and functioning conditions.

Internel measures applys software products which is not utilase during its development phase while it enables custumers to measure quality during the phase of software deveolopment as well as to forecaste final product quality.

Eksternal measures could be used for software product quality measurement valuation of their behaviour inside the system. Utilisation of those measurements is possible only if measeurement is realised in environment where software is utilised.

Literature analysis undelines that evaluation and software products choice are supported by certain MCDM methods that support approach evaluation of ISO 14598-1 standard description.

In fact, articles (19, 29,...) used AHP (MCDM method) model for software product evaluation principles. Furthermore, each evaluation criterium is based on ISO 9126-1 standard suggestions. Some authors base evaluation on 6 basic criterium while others use also other 27 sub-criterium in choice of software product.

In BSC model evaluation that includes environment protection elements inside Ad Barska plovidba , group AHP model would be adopted with evaluation based on 6 criterium and 27 sub-criterium.

Evaluation process will be realised in two parallel sessions through two teams:
1. Team 1 will be composed by experts from boths areas but they are not organisation's employees
2. Team 2 will be composed by competitive personnel from AD Barska plovidba's top management (including also environmental protection managers)

Team 1 will realise evaluation of quality criterium (6 of them) and sub-criterium (27 of them) based on internal measures. The objective is ability of software product evaluation to satisfy requests and needs of organisation looking from strategic aspects of organisation manageing and environmental protection.

Team 2 will realise quality valuation of criterium (6 of them) and sub-criterium (27 of them) based on external measures in order to evaluate level in which product software could satisfy organisation's request and needs looking from strategic aspects of organisation management and environmental protection.

With two evaluations (theoratical-internal and practical-external), Ad Barska plovidba organisation will obtain rang list of importance for each individual model. In this way, organisation will favorise most appropriate solution. The analysis that proposed different approaches to include environmental protection elements inside convetional BSC model, using the case of organisation at the same time propose information about model advanatges and disadvantages what in most make easy the

choice and other organisation that have at least one direction to environmental protection.

In the figure 9 we present group AHP model that evaluate BSC model that includes environmental protection elements:

1. MODEL 1 Link ECO BSC and convetional BSC inside already established prospective of convetional BSC

2. MODEL 2 Link ECO BSC and convetional BSC by creation of additional ECO prospective

3. MODEL 3 Include environmental protection elements in already established convetional BSC

MODEL 4 Include environmental protection elements in new created propsective in convetional BSC that will be oriented to environmental protection.
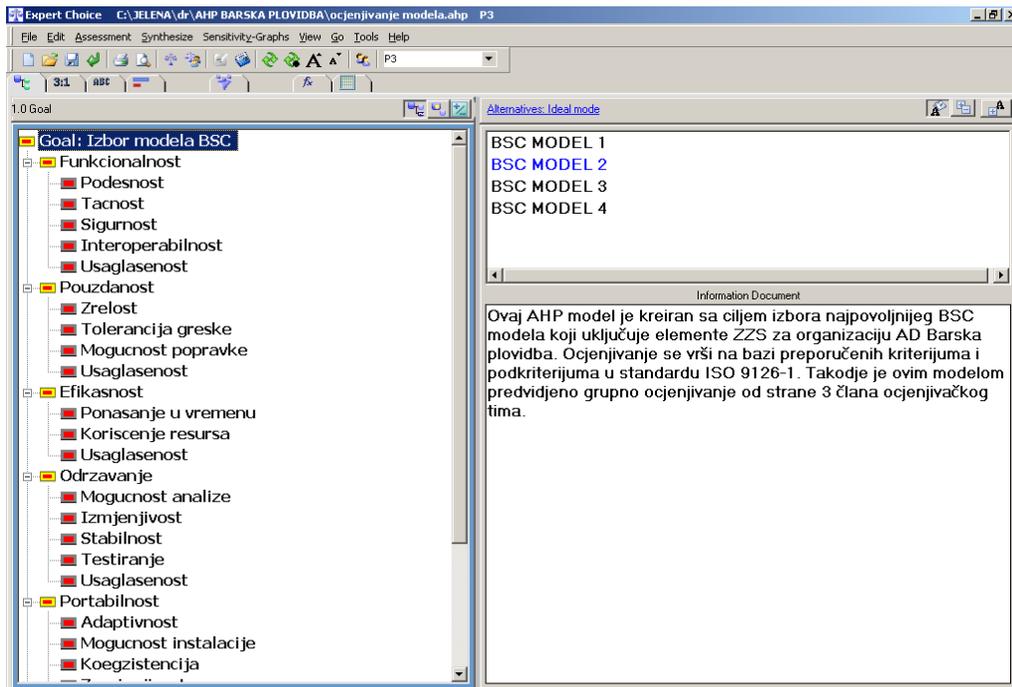

Figure 9. Group AHP model that decides between BSC model

Presented deciding group AHP model is realised through 4 hieriarcal levels:

Level I –Objective-BSCModel choice

Level II – Criterium – 6 of them proposed by ISO 9126-1 standard.

Level III – Sub-Criterium – 27 of them proposed by ISO 9126-1 standard.

Level IV – Alternative – 4 BSC models that include environmental protection

AHP model created like this includes all creterium and sub-creterium that are proposed by ISO 9126-1, without exeption. The reason for this is because group AHP decision methodology allows individual evaluation by idenfined team members. However, in case that all team memebers stay idenfiend by the same

criterium and sub-criterium and provoke non-consistent solution, new AHP model will eliminate criterium by which evaluation is not possible without adequate explanation what is in sense of ISO 9126-1 standard.

Having in mind that evaluation will be realised through 2 teams, what we undelined previously, two identical AHP models will be created. However, during evaluation teams will use different directions proposed by evaluation Leader. In fact, team 1, that is consisted by environmental protection and BSC experts that are not employed in AD Barska plovidba, will use internal measures frame proposed by ISO IEC TR 9126-3 Internal Metrics (32) for each quality sub-criterium, aiming creation of more

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detailed evaluation model. Following this way, each team member will have clear picture about importance of individual criterium and sub-criterium in evaluation model as well as model advatages concerning each of them. Analogically to previous team, team 2 is composed by competitive employees from top management from AD Barska plovidba (including also environmental protection managers). They will evaluate model concerning same set of criterium and sub-criterium but using external measures proposed by ISO IEC TR 9126-2 External Metrics standard (31) that are more oriented on evaluation of state in this environment.

5. CONCLUSION

In this research we propose four BSC models that include environmental protection elements inside Ad Barska plovidba. Models 1 and 2 are based on approach that focus creation ECO BSC. Following literature suggestions we realised two ways for its connection with convetional BSC. Models 3 and 4 do not include special map that is oriented on environmental protection, because its frame include prospectives and creation of additional prospective inside convetional BSC.

The most appropriate model for implemetation inside Ad Barska plovidba is

creation of group AHP model with multi-criterium choice and evaluation criterium that is defined by ISO 9126-1 standard.

In fact, even that ISO 14598 standard describes approach of software product evaluation and it is completly supported by ISO 9126 standard ' s criterium, we choose group AHP choice model for evaluation. AHP completly covers process described by ISO 14598 while it offers significant support for scale definition and evaluation of criterium as well as final sythesis and choice solution. On the other hand, this is not explicitly defined by standard. Evaluation and final choice of BSC model will be based on 2 AHP models that will be evaluated by two expets teams and solution sythesis will propose the most appropriate model for implementation inside AD Barska plovidba. The choice of model liket this, of course presents suggestition to all organisations that are oriented to environmental protection, but they have dilema during the choice of BSC approach that includes environmenatl protection elements.

However, after evaluation of this model (basing on 2 AHP models), it misses still final step concerning post- implementation of choisen model inside AD Barska plovidba. It should provide evaluation of quality model utilisation and additional approval choice.

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