Complementary Methods for Effective Decision Making

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Abstract. The development and empirical verification of the balanced scorecard (BSC) model, using the multi-criteria decision-making method called the analytic network process (ANP), are the key issues of the presented research. The paper presents the methodology of the prioritisation of the BSC goals with ANP method. Even though the prioritisation of the goals is possible with other method(s) findings from the empirical analysis showed that the ANP is more complementary with the BSC because of the influences among the goals in the BSC. The paper discusses special situations in prioritizing the BSC goals, i.e. understanding the ANP from the perspective of the user and the BSC with strategic goal(s) that do not directly influence any other strategic goal. Therefore, it can be asserted that introducing the ANP to implement the BSC and vice versa, improved the decision-making approach and the quality of the obtained results. The research was based on a case study of modelling the BSC for ebm-papst Slovenia LL Company, a manufacturing company.

Keywords: error correction model, analytic network process, balanced scorecard, key performance indicators, management, performance measurement system, sustainable growth, Slovenia.

1 Introduction

The paper presents the methodology of the prioritisation of the BSC goals with ANP method. Even though the prioritisation of the goals is possible with other methods i.e. analytic hierarchy process (AHP), findings from the empirical analysis showed that the ANP is more complementary with the BSC because of the influences among the goals in the BSC. The ANP supports the modelling of those influences (through dependencies) and the AHP does not. The paper discusses special situations in prioritizing the BSC goals; i.e. understanding the ANP from the perspective of the user and the BSC with strategic goals that do not directly influence any other strategic goal, and proposes solutions. Therefore, it can be asserted that introducing the ANP to implement the BSC and vice versa, improved the decision-making approach and the quality of the obtained results. The research was based on a case study of modelling the BSC for ebm-papst Slovenia LL (ebm-papst) Company, a manufacturing company.

Organisations can successfully execute strategies if strategic analyses and strategy maps are designed and understood by employees. Employees become truly empowered by motivation and understanding what the organisation wishes to accomplish and how they can contribute (Janeš 2014, 2015; Kaplan and Norton 2006; Aranda and Arellano 2010). Among the number of approaches for measuring business performance, several have attained a dominant position, e.g. AHP (Saaty 2008), ANP, (Niemira and Saaty 2004) and BSC (Kaplan and Norton 2004).

The AHP is a theory of measurement using pairwise comparisons and relies on expert judgements to derive priority scales. The AHP helps analysts to organise theoretical aspects of a problem into a hierarchical structure, similar to a family tree. By reducing complex decisions to a series of simple comparisons and rankings, and then synthesising the results, the AHP helps analysts to arrive at the best decision, and provides them with a clear rationale for the choices made (Saaty 2008). In addition to the

AHP, the ANP is a useful tool for prediction and for representing a variety of competitors with their interactions and their relative strengths to wield influence in making decisions (Saaty 2001).

The ANP is employed to identify causal relationships (Janeš and Faganel 2013; Janeš 2014) of a BSC's strategy map (Rahimnia and Kargozar 2016). The inclusion of a BSC provides a framework to ensure that all important criteria are examined and the relevant ones are included in the decision model. The ANP provides a convenient means of including BSC indicators interactions and their prioritization (Tjader et al. 2014). Both methods support the decision-making process (Saaty 2001), and they have been used in combination with several additional statistical and managerial methods.

The specific goals of this paper are the following:

- To present ANP and BSC methods used in developing the ANP-BSC models.
- To present benefits of the proposed approach by combining the ANP with the BSC.
- To present ANP and BSC models by means of a case study of the ebm-papst Company.

The literature has identified the necessity to further define the concept of causality within the layout of the BSC, in the direction of relying on specific quantitative tools needed to convert the BSC into a mathematical model. Therefore, based on the reviewed literature, the main characteristics of this approach have been depicted and, in particular, the potentialities of using the ANP to explore the concept of causality in the BSC have been stressed.

A key finding in this research is that the development of the BSC, supported by the ANP, contributes to the explanation of causal relationships in the BSC system (Janeš 2014; Janeš et al. 2018).

2 Literature review

2.1 The Balanced Scorecard

The most important management decision-making issues are strategic planning, analysis and the evaluation of strategy execution (Janeš 2014; Rigby 2017; Valmohammadi and Sofiyabadi 2015).

In practice, the top management evaluates the executives by their ability to execute strategy. However, managers struggle in closing the gap between strategy and actual results, which limits organisational growth, adaptability and competitiveness (Kumar Srivastava and Sushil, 2014; Tseng et al. 2015). Among the number of approaches for measuring strategy execution, i.e., business performance, a dominant position was achieved by the BSC (Hudnurkar et al. 2018; Kaplan and Norton 2004; Ratnaningrum et al. 2020); it has emerged as a new synthesis between the traditional financial accounting system and efforts to achieve long-term competitive capability. In this way, it provides key information about the activities of the managers. The superior usefulness of the BSC compared to any alternative system seems to be based on its specific performance measurement scheme. The way the BSC translates strategy into a set of key performance indicators (KPIs) and measures seems to better match the way managers build their own knowledge structures, helping them in processing performance information (Aranda and Arellano 2010; Janeš 2014; Kaplan 2012).

In general, the steps of the strategic planning and performance measurement of an organisation with the BSC are (Kaplan 2009; Hladchenko 2015):

1. Defining the strategic elements of the organisation: These include the values, vision (generally for three years) and mission, and destination statement. The destination statement supports the verification of selected strategic goals, KPIs (and measures) and their targets and initiatives, as well as their impact on changes in the organisation (Cobbold et al. 2004; Thanki and Thakkar 2018).

2. Defining strategic themes: The strategic themes stem from the vision of the organisation and can be recognized based on elements defined in the business model (Janeš et al. 2017). In addition, strategic themes represent the decomposition of overall strategy because they contain its basic parts, define

business processes that add value to customers and enable the classification of strategic goals (Faganel et al. 2020; Kaplan and Norton 2004, 2006; Kaplan 2012).

3. Defining strategic goals and their classification within strategic themes: This is a description of what needs to be done at the strategic level so that the chosen vision of the organisation is met. The organisation's goals, however, are what the organisation wants and expects from key stakeholders (Janeš 2015).

4. Creating a strategic map of four perspectives: This can be used to classify strategic goals in terms of financial and non-financial perspectives and the internal and external perspectives of the organisation (Hladchenko 2015; Hudnurkar et al. 2018; Janeš 2015).

5. Determining the causal links between the strategic goals and the identification of the strategic map: The causal links between strategic goals move in the direction from the learning and growth perspective and extend all the way to the financial perspective (Kaplan and Norton, 2004, 2006; Thanki and Thakkar, 2018). Different authors also suggested the use of several methods for the qualitative analysis, such as interviews with experts, the Delphi technique, brainstorming and Decision Making Trial and Evaluation Laboratory (DEMATEL) (Attri et al. 2013; Sumrit and Anuntavoranich 2013; Shih-Hsi et al. 2012; Valmohammadi and Sofiyabadi 2015).

6. Validation and empirical verification of the BSC: This can be performed with different types of software packages, e.g., SuperDecisions, EViews, etc. (Adams 2016; Janeš 2014, 2015; Kadoić et al. 2017; Janeš et al. 2017, 2018) in order to validate the extent to which the model matches the reality.

Despite its many benefits, the BSC approach has several critical deficiencies.

The BSC lacks dynamics, since it does not properly consider the effect of the dynamics existing within a system. The BSC literature makes a clear distinction between two types of performance indicators: the lagging (financial KPIs) and the leading (performance driver KPIs) (Albertsen and Lueg 2014). In other words, a key element in correctly specifying causal relationships is to consider their time dimension and magnitude (Barnabè 2011).

Furthermore, regardless of the prioritization and importance of the identification of the BSC's elements, the BSC still critically lacks resource allocation and compensation (Albertsen and Lueg 2014) consideration. BSC is a relatively complex and costly measurement system. How cognition affects the use of BSC needs to be acknowledged in order to understand that BSC's potential benefits can be limited by cognitive capabilities and characteristics of managers (Lipe and Salterio 2000; Ratnaningrum et al. 2020).

Since budgets and resources of organisations are limited, organisations cannot execute all proposed strategic initiatives which have critical impact on the organisational vision and mission. Therefore, organisations must identify and select the most viable strategic activities, as well as cost-beneficial projects, for optimizing the resource application. There are some existing linkages between resource allocation and strategic management under the BSC approach; nevertheless, the BSC, along with its improved approaches, still has not taken into consideration the limited resources of organisations. Reda (2017) argue, that if the core functions of organisation are explicitly represented in each BSC perspective, the latter should be important for materializing the input, process and output dimensions. Managers' responsibility is to understand the cause-end-effect relations in practice which are very complex constructions that require extensive analysis. This eclecticism of mixing elements of traditional accounting theory with a scientific ideal of cause-and-effect and dressing it all in an ambiguous common sense language gives the use of BSC a mythical rather than a scholarly character. One of the reasons for the relevance gap between managerial accounting research and practice is the language problem created by the very technical speech genre of much managerial accounting research (Nørreklit et al. 2012). Nielsen et al. (2017) argue that change is needed in the BSC which needs to be improved and replaced with new methods of intangible asset disclosures. According to Kaplan and Norton (2004, 2006) advice for the organisations is that they should follow to link all of their chosen BSC perspectives to compensation and not just the financial one (Albertsen and Lueg 2014). Therefore, the improvement of this issues will provide a practical strategic management approach in real-life managerial situations

(Rahimnia and Kargozar 2016; Thakkar et al. 2006; Tseng et al. 2015; Valmohammadi and Sofiyabadi 2015; Wudhikarn 2016).

Next deficiency is manifested as tangible 'proxies', such as defect and absenteeism rates and customer satisfaction surveys, which are used to capture the intangible attributes (Janeš 2014; Novak and Janeš 2019). Moreover, goal surrogate measures often inaccurately reflect intangible criteria. Nonetheless, subjective evaluations are vulnerable to accusations of favouritism or other kinds of abuses, whereas goal measures may be perceived as more fair and transparent.

Another critical consideration is how the weights of the subjective and objective criteria should be determined if both types of criteria are used in the BSC (Leung et al. 2006). Therefore, a number of researchers, authors and scholars have tried to resolve some of the aforementioned deficiencies by applying multi-criteria decision-making (MCDM) methods, such as the technique for order of preference by similarity to ideal solution (TOPSIS), AHP or ANP. MCDM methods have distinctiveness in fitting to the weaknesses and complexities of BSC, especially multiple criteria consideration (Bentes et al. 2012; Bhattacharya et al. 2014; Huang et al. 2011; Hudnurkar et al. 2018). Hence, AHP has been empirically identified to add several advantages to BSC, such as multi-criteria prioritization, comparative analysis of business performance and qualitative and quantitative determination. Nevertheless, for numerous applications, there are still some criticisms as far as the integration of BSC and AHP is concerned, specifically for the lack of dependency consideration within the BSC's dimensions and indicators. It seems reasonable to suggest that the more complex the interactions, the greater the need to utilize the ANP (Chang 2013; Leung et al. 2006; Thanki and Thakkar 2018). This MCDM concept has distinctive identities that fit the BSC above other methods, as the ANP could consider qualitative or quantitative data and also dependency among elements for the entire model (Wudhikarn 2016).

An ANP model consists of a network of nodes which are grouped into clusters. In the case of ANP modelling, clusters represent the perspectives of a BSC, nodes represent the strategic goals and arcs represent the cause-effect relationships. It should be noted that the arcs in the ANP model are in the opposite direction from those in the strategy map (see Figures 2 and 3). The goal of the method is to find those causal relationships between the strategic goals. To do this, the method starts with a network that includes all possible arcs, and then those which are not important are eliminated from the goal network, resulting in a strategy map of the organisation (Quezada et al. 2014).

Using the ANP/AHP alone without the aid of the BSC, the decision maker might develop a model with an incomplete set of decision criteria and/or with some of the criteria being repeated. The inclusion of the BSC (Tseng et al. 2015) provides a framework to ensure that all important criteria are examined and the relevant ones are included in the outsourcing decision model. The ANP provides a convenient means of including the BSC indicator interactions and prioritizing the BSC indicators (Tjader et al. 2014). Moreover, the algorithm for the ANP accounts for all of the performance measures included in the BSC. This alleviates the negative influence of judgment biases when decision makers use the BSC as part of their performance management (Hu et al. 2015).

2.2 The Analytic Network Process

ANP is, like AHP, founded on a ratio scale measurement and pairwise comparisons of elements to derive priorities of selected alternatives (Saaty 2001).

The main function of the ANP is to determine the relationship of a network structure on the degree of interdependence (Poveda-Bautista et al. 2012). Once the measures are identified, the second most important question is the weight that should be given to each particular measure in designing the model. For example, the BSC's measures are derived from the interrelated strategic goals of the organisation; hence, in deriving their weights, these relationships are quite useful (Thakkar et al. 2006). Therefore, influence is a central concept in the ANP. It is a useful tool for prediction and representation, and for representing a variety of competitors with their surmised interactions and their relative strengths to wield

influence in making decisions. When the decision-making process involves attributes that have a dependency relationship, the problem should be modelled as an ANP (Saaty 2001). Most complex real-world decision-making problems have numerous interdependent elements that can be captured and processed utilizing the feedback and interaction capabilities of an ANP model (Saaty and Ozdemir 2004; Tjader et al. 2014).

According to Thakkar et al. (2006), ANP is a multi-attribute decision-making approach, based on the knowledge, experience and perceptions of experts in the field. Even though it does not provide an optimal solution (from a cost perspective), it is valuable for decision-making, involving intangible attributes that are associated with strategic factors. The use of the ANP method provides the means to accommodate interrelationships of organisational goals, for determining the weights for various BSC perspectives, and this makes the results more valuable and realistic.

In the last two decades, contributors have applied the ANP in many operational and managerial areas. Ravi et al. (2005) combine the BSC and the ANP to conduct reverse logistics operations for end-of-life computers. Nakagawa and Sekitani (2004) utilise the ANP for supplier selection (Gencer and Gürpinar 2007) and supply chain performance evaluation (Jharkharia and Shankar 2007). Niemira and Saaty (2004) use the ANP for financial crisis forecasting. Leung et al. (2006) use the AHP and the ANP to facilitate the implementation of the BSC (Aranda and Arellano 2010). Gencer and Gürpinar (2007) suggest that user-friendly software would help managers apply the ANP more easily in decision-making (Kadoić et al. 2016). Wu and Lee (2007) use the ANP for knowledge management strategy selection. Lin et al. (2008) utilise the ANP to find the most optimal dispatching method. Yüksel and Dağdeviren (2010) integrated fuzzy ANP and BSC to measure the performance of a manufacturing firm in Turkey (Chang 2013). Poveda-Bautista et al. (2012) combines the use of the ANP method with the BSC to achieve competitiveness indicators. Bhattacharya et al. (2014) used a fuzzy ANP based green-balanced scorecard (GrBSc) within the collaborative decision-making approach to support accurate and timely data flow across all cross-functional areas of an organisation.

The achievements of the ANP can be observed from its diverse applications and areas of usage, such as economics, business, benchmarking, education, manufacturing, project management (Cheng and Li 2005), product development, sociology, green supply chain management (Bhattacharya et al. 2014), politics, etc. (Begičević et al. 2007; Wudhikarn et al. 2015; Janeš et al. 2017, 2018; Kuo and Lin 2012; Moalagh and Ravasan 2013; Saaty and Begičević 2010; Tavana et al. 2013; Wudhikarn 2016).

3 Methodology

The inclusion of the BSC provides a framework to ensure that all important criteria are examined and that the relevant ones are included in the decision model (Quezada et al. 2014; Tjader et al. 2014).

The methodological approach used in the presented research was based on a comprehensive review of academic and professional literature, a pool of the existing models, meta-analysis and a number of executive managers' consultations. Further, it was based on background research and an analysis of AHP, ANP and BSC characteristics.

The research was performed as a case study of modelling the BSC system for a manufacturing company and founded on the complementary use of qualitative and quantitative methods. The strategic map of the company that contains the causal relationships between its strategic goals and their respective KPIs has been set and confirmed with the executive management (Bititci et al. 2006; Janeš 2014, 2015). The proposed approach uses the ANP and aims at identifying the causal relationships of a BSC. Basically, what the method does is estimate the importance of the relationships, and then selects those relationships that are considered important according to executive management (Bititci et al. 2006; Janeš 2014; Rahimnia and Kargozar 2016).

The research's goal was to analyse the benefits of the proposed approach of combining the ANP and BSC methods. The methodology was performed using the following steps (Quezada et al. 2014; Wudhikarn 2016; Janeš et al. 2018):

1. With qualitative analysis and the designed BSC system (Janeš 2014; Kaplan and Norton 2004), a starting-point, for the quantitative analysis was prepared (see Figure 1).

2. The ANP-BSC model was designed. Since the ANP method includes dependencies among criteria in the consideration (not influences directly), the current BSC's strategic map was firstly converted into a model with dependencies. Secondly, in terms of the ANP decision-making problem, the current BSC model (Figure 1) was truncated. One of the characteristics of decision-making with the ANP is the inseparability of criteria and alternatives. In this case, if goals represent criteria level, then the alternative level is missing. In terms of Calculating the limit matrix of the ANP method, that means that some BSC goals will have priority 0 (e.g., if some criterion/BSC goal has no influence on any other). To avoid this, we proposed a variant of adding a fictive alternatives cluster with only one node (Alt). Therefore, each BSC goal was connected with an alternative node in order to obtain feedbacks (the alternative was not connected with all the BSC goals). That ensured that each BSC goal had at least one graph-walk in which it was a source and destination (none of the goals would have the priority 0). The ANP-BSC model is presented in Figures 2 and 3.

3. Prioritization of the BSC goals by using the ANP corresponded to creating the unweighted supermatrix and filling it with priorities and creating the weighted supermatrix. The comparisons that were done included pairwise comparisons of goals from the same cluster with respect to the goal, as well as pairwise comparisons of the clusters. On the other hand, the comparisons that had to be done were pairwise comparisons of the BSC goals that were influenced by the same goal and, less often, pairwise of clusters that are influenced by the same cluster (perspective). All pairwise comparisons that in some way included an alternative node (and alternative cluster) were not done: as explained, this alternative cluster/node is fictive and this node must not contribute to any node in terms of pairwise comparisons. The procedure of criteria pairwise comparisons with respect to other criteria (in this case, comparisons of the goals with respect to other goals) is often very complex, time-consuming and difficult for the users to understand (Kadoić et al. 2017; Saaty and Begičević 2010), but this procedure can be enhanced as presented in Kadoić et al. (2017).

4. Once the results are obtained, in the case that some alternatives achieve very similar results, a sensitivity analysis should be carried out in order to demonstrate the robustness of the ranking obtained (Poveda-Bautista et al. 2012).

5. Additionally, it is possible to upgrade the prioritization of the BSC goals with analysis of benefits, opportunities, costs and risks (BOCR) as presented in Janeš et al. (2018).

4 Prioritisation of the BSC goals of the ebm-papst Company

4.1 Balanced Scorecard
The ebm-papst Company is organised as a competence centre that produces and develops machines, appliances and electric motors for home appliances.

Figure 1: The ebm-papst's BSC
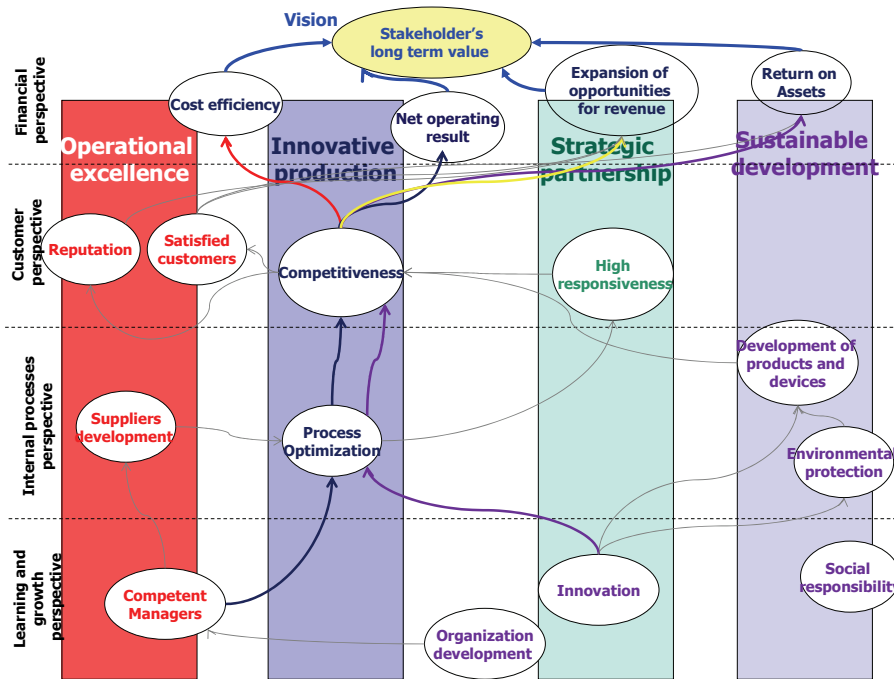
Adapted from Janeš, 2014

The company's understanding of its business performance sustainability, which is based on comprehensive data tests and workshops and semi-structured interviews with three of the ebm-papst Company's executive managers, contributed to the selection of the strategic goals in the BSC's perspectives (Figure 2; Janeš 2014, 2015; Janeš et al. 2018). The strategic goals are arranged according to importance as stated by the executive management in the following sequence:

1. Financial perspective: Expansion of opportunities for revenue (Revenue), Cost efficiency, Net operating result and Return on assets (ROA).
2. Customer perspective: Competitiveness, High responsiveness, Reputation and Satisfied customers.
3. Internal process perspective: Development of products and devices (Development of PD), Process optimisation, Development of suppliers and Environmental protection.
4. Learning and growth (LG) perspective: Competent managers, Organisation development, Innovation and Social responsibility.
In Figure 2 the BSC strategic goals (nodes) and their respective relationships (arcs) are presented.

4.2 Designing the ANP-BSC model

The initial ANP model consisted of five perspectives (clusters), which included strategic goals (nodes) with cause-effect relationships (arcs). The modelling process only considered relationships on the basis of grounded cause-effect relationships among the strategic goals. The cluster, Vision, and its node, Stakeholders, have been substituted for the Goal and fictive cluster Alternatives (Figure 3). The model is designed based on the Super Decisions (Adams 2016) simple network template (see Figure 2 and 3).

Figure 2: ANP model with important goals (nodes) and cause-effect relationships (arcs)
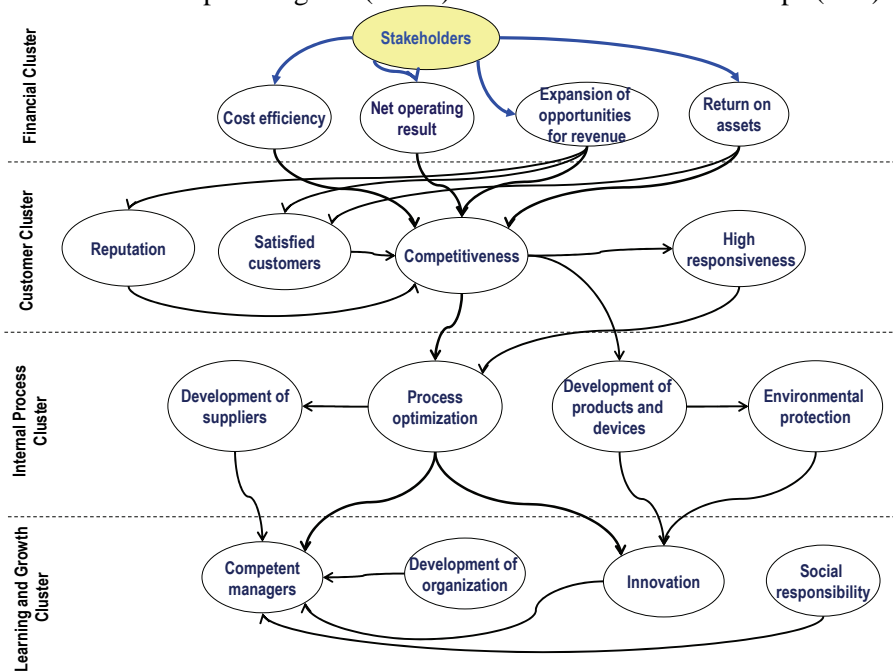

Adapted from Janeš et al. 2018

As a next step, pairwise comparisons between nodes were carried out in order to obtain priorities. For each comparisons matrix, the inconsistency ratio was calculated, which was under the limit of 0.1. To this end, the pairwise comparisons for the nodes in each cluster that belong to a parent node were carried out for all the parent nodes in the model (Figure 3).

In the presented research, all clusters that represent BSC perspectives are equally important. Thereafter, the unweighted and weighted matrixes were calculated. In the presented simple, straightforward network of clusters, nodes and arcs, process of obtaining the limit matrix was performed in order to raise the weighted supermatrix to powers until all the columns in the matrix have the same values so the priorities of all nodes can be read from any column (Table 1).

Figure 3: ANP model in SuperDecisions
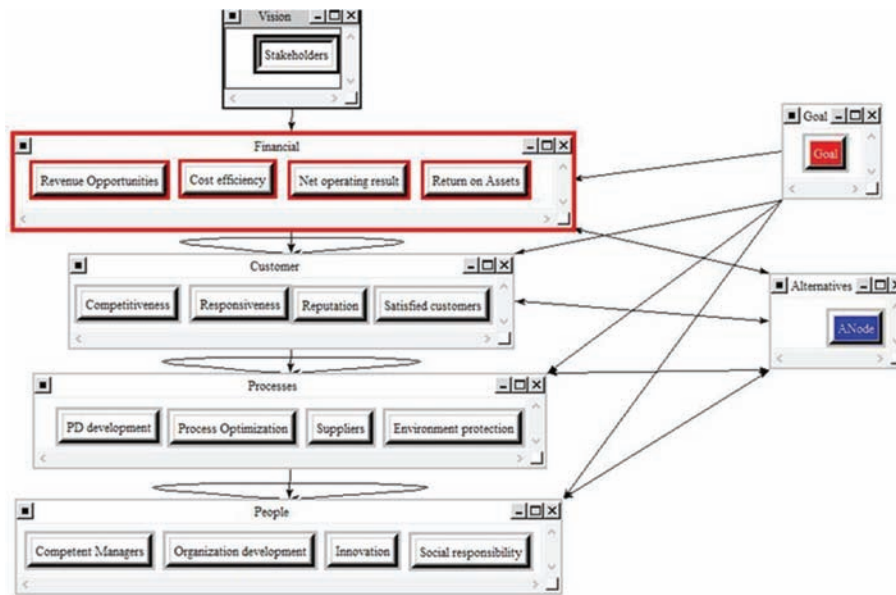
The Financial cluster with its nodes, Revenue, Cost efficiency, Net operating result and ROA, appears to have a relatively minor priority according to the limit matrix (0.0203), which is not the case according to the interviews with the managers (Table 1).

In the Customer cluster, the highest priority belongs to node Competitiveness (0.158562), which is the most important node among all nodes and is followed by High responsiveness (0.046817).
This result is in accordance with the importance stated by the executive management. Reputation (0.015420) and Satisfied customers (0.011165) appear to have a relatively lower priority, but aligns with the company's ranking of the nodes (Table 1).

In the Internal processes cluster, the highest priority node is Development of PD (0.058423), followed by Process optimisation (0.042340) and Development of suppliers (0.028590) and Environmental protection (0.021127), which is in accordance with the importance stated by the executive management (Table 1).

In the Learning and growth cluster, the highest priority node is Competent managers (0.106192) followed by Innovation (0.064771), which surpassed Organisational development and Social responsibility (0.020300) (Table 1).

Table 1: Limit matrix with priorities

Perspective-Cluster		
	Strategic goal-Node	Priorities
Financial	Revenue	0.020300
	Cost efficiency	0.020300
	Net operating result	0.020300
	Return on assets	0.020300
Customer	Competitiveness	0.158562
	High responsiveness	0.046817
	Reputation	0.015420

	Satisfied customers	0.011165
Internal processes	Development of products and devices	0.058423
	Process optimisation	0.042340
	Development of suppliers	0.028590
	Environmental protection	0.021127
Learning & growth (People)	Competent managers	0.106192
	Organisation development	0.020300
	Innovation	0.064771
	Social responsibility	0.020300

Adapted and simplified from Janeš et al. 2018

4.3 ANP-BSC model implications

One of the main areas that both the relevant literature and Kaplan and Norton themselves identified as critical is related to the identification, assessment and quantification of causal relationships which are essential within the BSC (Barnabè 2011). In this context, the causal relationships have been at the centre of survey interest because they provide a better relationship model among the four BSC perspectives and their respective strategic goals, which are defined in a subjective way. Even though this way of working is widely accepted in practice, some studies have shown that the declared relationships are not necessarily valid. In order to overcome this situation, the proposed ANP provides a quantitative tool in order to establish the relationships among strategic goals (Janeš 2014; Kadoić et al. 2017; Quezada et al. 2014; Kadoić, Begičević and Divjak 2017). After the workshops and semi-structured interviews with the managers, they established that the designed strategy map represented the company's strategy (Figure 1).

It should be noted that the arcs (Figure 2) were changed in the opposite direction from the BSC model cause-effect relationships. The ANP model indicated that, if the managers' competencies and the development of suppliers were improved, then the process optimisation and labour productivity might improve. Similarly, to improve the customers' satisfaction, it is necessary to improve the competitiveness of the optimised production processes.

The advantage of using the ANP is that it allows for the inclusion of dependence and feedback on the strategic goals and perspectives in the strategic map. From a practical point of view, the presented method is a good alternative for designing a strategy map of a company, which uses an ANP approach that has been successful in many other areas of management. Therefore, it opens new possibilities for research. It should be noted that the presented ANP approach is in accordance with the findings of the Engle-Granger two-step method approach used in previous research performed by Janeš (2014, 2015).

Analysis of possible modifications of the ANP in terms of the prioritization of BSC goals is also considered:

1. Inclusion of influences in goals prioritizing support: The ANP (with its modifications) supports influences.

2. Complexity (number of comparisons): The number of comparisons in the ANP method and its modifications are higher because pairwise comparisons of the BSC goals, with respect to other BSC goals that influence them, have to be done (in an AHP the number of pairwise comparisons remains the same).

3. Duration: The ANP has the longest with comparison to AHP. In the case of the ANP conducted over the weighted strategic map of the BSC goals, duration falls somewhere in between that of both methods.

4. Understanding the procedure: The procedure of comparing the BSC goals with respect to the goal that influences them is often difficult for users to understand. For that reason, application of the ANP over a weighted graph is the most appropriate option.

5. Dealing with the BSC goals that do not influence any other BSC goal: In this case, the best analysis option is the ANP with the fictive alternative cluster and goal.

Based on the qualitative analysis, it can be concluded that the best option for the BSC goals prioritization depends on the specific case and the experience with the ANP method of the decision maker. If the decision maker is acquainted with the ANP, but does not understand the pairwise comparisons of goals with respect to the third one, the best choice is to make a weighted strategic map of goals and automatize the ANP. If the BSC contains strategic goals that do not influence any other strategic goal, it is advisable to use the ANP with the fictive alternative. Finally, if the decision maker is not familiar with the ANP, there is always the opportunity of using the AHP method (Janeš et al. 2017, 2018).

5 Conclusions

Organisations do not function as pure mechanical or pure organic systems and they do not relate together or run by simply making a decision. The operating causalities must be constructed (Janeš 2014, 2015; Janeš et al. 2018). Also, to control model causality, strategic map have to be developed (Nørreklit et al. 2012).

The literature has identified the necessity to further define the concept of causality within the layout of the BSC in the direction of relying on specific quantitative tools needed to convert the BSC into a mathematical model. Therefore, based on the reviewed literature, the main characteristics of this approach have been depicted, and, in particular, the potentialities of using the ANP method to explore the concept of causality in the BSC have been stressed. It should be emphasized that both BSC model and ANP method are at least partially subjective in the sense of selecting, prioritizing and defining causal relationships between goals of the organisation and identification of KPIs.

A key finding in this research is that the development of the BSC, supported by the ANP, contributes to the explanation of causal relationships in the BSC system. However, it must be emphasised that the generalisation of the research findings was limited to only one manufacturing company. Based on the results, it is recommended that further research be oriented towards expanding the ANP-BSC to other organisations, and to use the causal relationships to forecast the future trajectory of the strategy in order to generalise findings and acquire new knowledge.

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