# EVALUATION OF CORPORATE SOCIAL PERFORMANCE BASED ON AHP/ANP APPROACH

**Štěpánka Staňková**

**Abstract**

Generally, the Corporate Social Responsibility concept could be understood as a voluntary commitment of various organizations to follow principles of an overallsustainability and a social engagement. Nowadays, an exact measurement is a very questionable and difficult task, however, it is considered to be crucial for managerial decision making and a following company development, as well. Another possibility to assess CSR performance of a selected sample of organizations is connected with a usage of multiple-attribute decision- making methods (MADM methods) together with a content analysis of existing CSR reports, internet presentations and CSR publications monitoring CSR approaches of chosen organizations. The main goal of this paper is connected with the application of the Analytic Hierarchy Process method (AHP) and Analytic Network Process (ANP) in a complex CSR assessment of selected banking organizations operating in the Czech Republic.Both methods brought the same ranking of the organizations within the sample. *Českáspořitelna, a.s.* achieved the best scores and it was considered to be the most successful bank. *Komerčníbanka, a.s.* took a second place and *UniCreditbank Czech Republic, a.s.*was placed in the third position.

**Key words:**Corporate Social Responsibility, Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), Multiple-Attribute Decision Making, Banking sector

**JEL Code:**M14, L21

## Introduction

In 1953 the American economist Howard R. Bowen (Putnová and Seknička, 2007) introduced his book named Social Responsibilities of Businessman that served as a source of inspiration for the title of the special study named Corporate Social Responsibility (in short CSR). Due to a spontaneous development of the CSR study integrating a plenty of scientific disciplines and expert opinions, a diverse terminology relating to various measurement methods causes difficulties connected with different interpretations of CSR results and performance. The main goal of this paper is focused on the evaluation of CSR activities in

selected banking organizationsbased onthe AHP/ANP methods. A theoretic part of this paper is focused on more detailed characteristic of the CSR concept and contemporary possibilities of CSR measurement. The AHP and ANPmethod are described in methodological section, followed by results and conclusions.

# 1 Theoretical Basis of Corporate Social Responsibility

The stockholder theory (1970) by Milton Friedman together with Richard Edward Freeman´s stakeholder theory (1984) represents foundations of the CSR concept that, in fact, polarize opinions of these issues (Putnová and Seknička, 2007).According to Kunz (2012) a long-term orientation, a systematic approach and voluntariness together with unlimited possibilities of a practical application are considered to be characteristic features of the CSR definitions. Contemporary authors such as Coombs and Holladay (2012), Horrigan (2010), Seuring (2012) and Uyan-Atay (2013) are familiar with a triple-bottom-line concept presented also by the European Union that includes three basic areas of interest: Profit, Planet and People. A responsible organization conducts business transparently, respects Corporate Governance rules, ethical marketing policies and ethical codes, pays attention to quality, innovations or safety and is universally beneficial to its community (**Profit**). An environmentally sustainable organization uses environment-friendly technologies, supports their development and reduces its environmental impacts (**Planet**). A responsible organization also fully respects human rights, occupational health standards and is fair in relation to its stakeholders (**People**).

# 2 Research Methodology

The main benefits of MADM methods are seen in a systematic decomposition of a complex decision-making tasks into smaller parts that enables decision makers to express explicitly (not intuitively) their opinions on criterion importance (preference). Thus the whole process of decision making becomes transparent, easy to understand and clear for other stakeholders more or less involved in decision-making procedures (Franek and Zmeškal, 2013).

## 2.1 Analytic Hierarchy Process

The AHP method was first introduced by its author Thomas L. Saaty at the beginning of 1970s. This MADM method is based on a decomposition of a decision-making problem forming a top-down structure called a hierarchy and pair-wise comparisons. It is assumed that each component of a hierarchy is independent(i.e. there are no relations and loops among

components). The first level of a hierarchy is usually represented by a clear specification of decision-making goals or tasks. The second level is connected with a formulation of criteria influencing a final decision while the third layer includes sub-criteria giving accuracy to every criteria belonging to the previous level. Finally, the fourth level symbolizes a list of considered options between which decision-making processes are realized (Saaty, 2000).

Before a beginning of pairwise comparisons appropriate number of Saaty´s matrices (symbolically marked**S**) corresponding with a hierarchic structure has to be prepared. The Saaty´s matrix has as many rows and columns as there is the amount of components (criteria, sub-criteria and options) of each hierarchical level. The judgements are written in the matrix answering the question: How much more important is one component on the left side of the matrix in comparison with another at the top of the matrix with respect to its impact on the level above? When components in rows are preferred to those in columns, then a numerical expression of magnitudes ranges between ⟨1;9⟩. Value 1 corresponds with an equal importance (indifference), number 3 means "moderately more", number 5 "strongly more", number 7 "very strongly more" and number 9 "extremely more". The values 2, 4, 6 and 8 are used to express a compromise or an intermediate stage of the ratio scale. In the opposite case estimated magnitudes are expressed on an inverse scale ranging between$\langle 1/2 ; 1/9 \rangle$. The matrix is reciprocal which means that its elements, marked si,j, which are symmetric with respect to the diagonal, are inverses of one another, $s_{i,j} = 1/s_{j,i}$. Moreover, the elements on the diagonal express equality and are assigned to the value 1 (Saaty, 2000; Zmeškal 2012).

Once all paired comparisons on every hierarchical level are made a computation of normalized local weights $w_i$, representing a contribution to the parent node in the level immediately above, follows. Local weights $w_i$could be calculated for example using geometric mean of rows of Saaty´s matrix **S** according to a mathematic formula (1), where $N$ represents the order of Saaty´s matrix $S$ with elements $s_{i,j}$.

$$w_i = \frac{v_i}{\sum_i^N v_i} = \frac{\left[\prod_j^N s_{i,j}\right]^{\frac{1}{N}}}{\sum_i^N \left[\prod_j^N s_{i,j}\right]^{\frac{1}{N}}}. \qquad (1)$$

A requirement of meeting the transitivity condition resulting in the demanded consistency of Saaty´s matrices is necessary to obtain a high-quality evaluation and reliable

results. To assess the consistency an eigenvalue $\lambda_{max}$ must be computed with respect to a mathematic procedure given below:

$$\lambda_{\max} = \frac{1}{N}\sum_{i}^{N}(S \cdot w)_i / w_i , \qquad (2)$$

where*N* is the order of Saaty´s matrix **S**, *w* symbolizes an eigenvector of weights $w_i$ and $(S \cdot w)_i$ stands for*i*-th element of vector *w*. A next step is connected with a calculation of the Consistency Index (CI) and Consistency Ratio (CR) according to a formula:

$$CR = \frac{CI}{RI} = \frac{\frac{\lambda_{\max} - N}{N-1}}{RI} , \qquad (3)$$

while the Random Index (RI) is determined empirically depending on the order of Saaty´s matrix **S** and ranging values mentioned in Table 1. The value of Consistency Index must definitely meet a condition: $CR \leq 0{,}1$.

**Tab. 1: Summary of RI values**

| **N** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **RI** | 0,00 | 0,00 | 0,58 | 0,90 | 1,12 | 1,24 | 1,32 | 1,41 | 1,45 | 1,49 |

Source: Zmeškal (2012)

To obtain the global importance of each sub-criterion considering the overall goal ($W_{ij}$), the local weights of criterion $w_i$ are multiplied by the local weights of the *j*-th sub-criterion according to its effect on the *i*-th criterion:

$$W_{i,j} = w_i \cdot w_{i,j} . \qquad (4)$$

The AHP method is based on a principle of utility maximization that is why the option with the highest sum of the global weights is chosen. This approach is called a distributive mode synthesis (Saaty, 2000; Álvarez, Moreno and Mataix, 2012).

## 2.2 Analytic Network Process

Saaty and Vargas (2006) describe the ANP method as a tool for solving decision-making tasks that cannot be structured hierarchically because they include interactions and mutual relationships among the elements of a decision-making network. Basically, the ANP is an extension of the AHP method and it is suitable for a more complex and systematic

analysis.The network structure does not have the linear form of a hierarchy with strictly defined levels. By contrast, elements are grouped in components(clusters) that form a system with relationships, inner and outer dependencies or loops. Currently, the ANP is applied in various decision-making problems. Especially in the field of CSR the ANP approach was applied for example by Shiue and Lin (2012) or Hsu, Hu, Chiou and Chen (2011).

Once a decision-making task is structured, a procedure of pair-wise comparisons, importance (preference) appraisals and priority vectors computations is similar to the AHP (see Chapter 2.1). The only difference is that the elements of each component are compared pair-wise according to their importance towards their control criterion. The components are assessed with respect to their contribution to a goal. In a case of interdependencies among elements (components), a set of pair-wise comparisons need to be carried out to measure the influence among the elements (components). The results of pair-wise comparisons are written in Saaty´s matrices.

In the next step, calculated local priority weights ($w_{i,j}$) derived from all possible and logical pair-wise comparisons are entered in an appropriate position within an overall matrix, known as an initialsupermatrix. A standard initialsupermatrix is organized as follows:

$$W = \begin{array}{c} goal \\ criteria \\ sub-criteria \\ alternatives \end{array} \begin{bmatrix} W_{11} & \cdots & \cdots & W_{1n} \\ W_{21} & W_{ij} & \cdots & W_{2n} \\ \vdots & \cdots & \cdots & \vdots \\ W_{n1} & W_{n2} \cdots & W_{n(n-1)} & W_{n,n} \end{bmatrix}, i=1,\ldots,n; j=1,\ldots, n \qquad (5)$$

To find a convergent solution it is necessary to transform an initial supermatrix into a weighted supermatrix$\bar{W}$. Finally, a weighted supermatrix$\bar{W}$is used for a computation of a limit supermatrix$\bar{W}^{\infty}$ according to a formula:

$$\bar{W}^{\infty} = \lim_{k\to\infty} \bar{W}^{k}, \qquad (6)$$

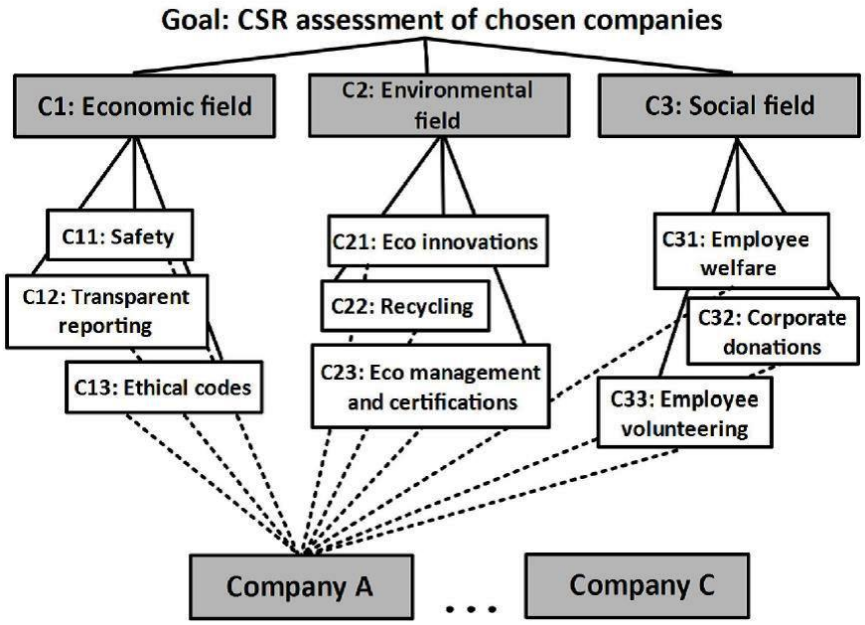
where*k* is an arbitrarily large number (for further details, seeFranek and Zmeškal, 2013, Shiue and Lin, 2012).

## 3 Utilization of AHP and ANP in Corporate Social Responsibility

Concerning the AHP method first of all, it was necessary to create a hierarchic network with respect to a main goal that is connected with the evaluation of CSR activities of three selected organizations operating in the Czech banking sector. Each criterion was chosen according to the triple-bottom-line definition of CSR (see Chapter 1) while it was specified by three sub-

criteria. It is assumed that every responsible organization fully respects law regulations and that is why the sub-criteria mainly focus on above-standard commitments and activities. The graphic representation of the hierarchic structure together with the indication of criteria, sub-criteria and options (organizations) is shown in Figure 1.

**Fig. 1: Hierarchic decomposition of decision-making task**



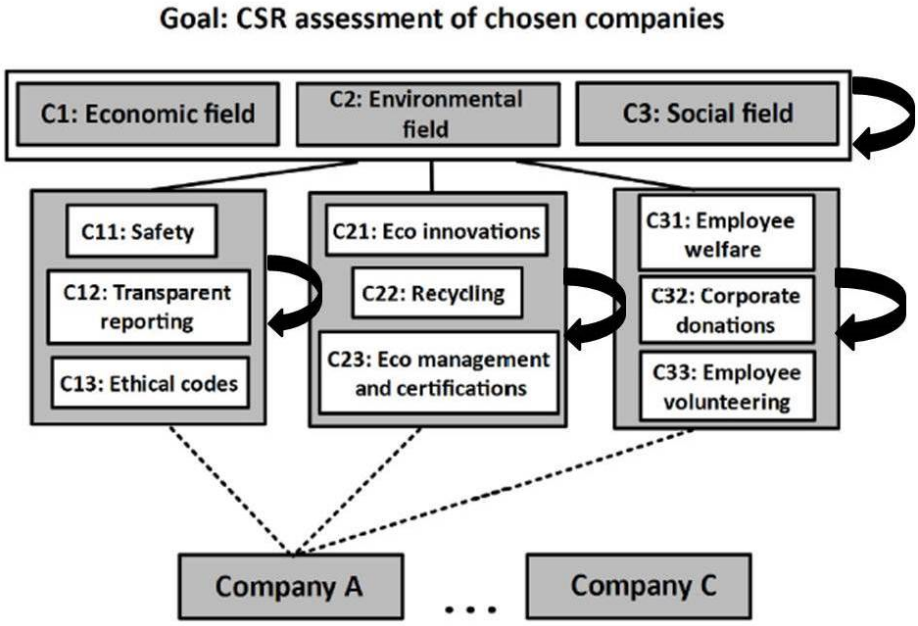

Source: own adaptation according to the CSR definition (Horrigan, 2010)

In second step, the importance (preference) appraisal of criteria and sub-criteria was accomplished by an expert. Thirdly, local and global weights of criteria and sub-criteria were calculated. Fourthly, a CSR evaluation of chosen companies was accomplished. A CSR performance of the three banking organizations was appraised by author´s opinions based on information got from a content analysis of current internet presentations, CSR reports and other available publications and surveys. *Českáspořitelna, a.s.* is marked with the expression "Organization A", *Komerčníbanka, a.s.* is called "Organization B" and finally *UniCreditbank Czech Republic, a.s.* is labelled "Organization C". According to the results of the Czech Top 100 Most Admired Firms survey held in 2014, all of these organizations are considered to be an essential part of the Czech banking sector.

As for the ANP method, a network was designed (see Figure 2) respecting the same goal. It is assumed that there are loops in each cluster (i.e. it means inner dependence between groups of elements).In second step, the importance (preference) appraisal of components and elements was accomplished by an expert. Thirdly,a CSR evaluation of chosen companies was

accomplished. Fourthly, an initial supermatrix was computed and through a mathematical procedure described in Chapter 2.2 a convergent solution was obtained.

**Fig. 2: Network structure of decision-making task**




Source: own adaptation according to the CSR definition (Horrigan, 2010)

## 4 Results

According to Table 2, obtained priority weights represent a starting point for a complex CSR performance evaluation. Based on the results of both methods the CSR fields were ordered identically. In view of the fact that the selected organizations represent the Czech banking sector the economic field (C1) was rated to be the most preferred criterion. As for AHP method, the economic field scored 67 % in comparison with 42 % computed by the ANP approach.Moreover, the social field (C2) and the environmental criterion (C3) were considered to be more important according to the ANP method. It is obvious that assessed importance of the CSR fields tends to be more equally distributed according to the ANP than AHP procedure. Concerning priority weights of CSR sub-criteria, the economic criterion (C11) connected with an overall safety which means responsible investment, an observance of occupational health and safety standards, fair behaviour of managers and staff etc. was assessed as the most important one. It was followed by the criterion (C13) dealing with various ethical codes and (C31) focused on employee welfare. According to scores of both methods, only the criteria C12 (Transparent reporting), C22 (Recycling) and C32 (Corporate

donations) were ordered differently. The criteria C21 (Eco innovations), C32 (Employee volunteering) and C33 (Eco management and certifications) were the less preferred factors.

**Tab. 2: AHP/ANP Comparison of computed priority weights**

| Field | AHP | ANP | Sub-criterion | AHP | ANP |
|---|---|---|---|---|---|
| **Economic field** | 67,38 % | 41,79 % | Safety | 36,36 % | 18,10 % |
| | | | Transparent reporting | 11,01 % | 8,47 % |
| | | | Ethical codes | 20,01 % | 16,17 % |
| **Environmental field** | 10,07 % | 22,39 % | Eco innovations | 3,13 % | 8,11 % |
| | | | Recycling | 4,97 % | 9,59 % |
| | | | Eco management and certifications | 1,97 % | 4,03 % |
| **Social field** | 22,55 % | 35,82 % | Employee welfare | 14,10 % | 15,82 % |
| | | | Corporate donations | 5,38 % | 12,18 % |
| | | | Employee volunteering | 3,08 % | 7,53 % |

Source: own computations

The final results required for the complex assessment of the CSR approaches of the selected banks were obtained using a distributive mode synthesis described in Chapter 2.1. A detailed overview ofcomputed priority weights is given in Table 3.Based on the results of both methods the organizations were ordered identically and their scores were nearly the same.*Českáspořitelna, a.s.* (Organization A) was considered to be the most successful firm from the sample (AHP: 53 %, ANP: 51 %). *Komerčníbanka, a.s.* (Organization B) scored 31 % according to results of AHP and 33 % according to ANP method. Based on the AHP and ANP outcomes *UniCreditbank Czech Republic, a.s.* (Organization C) accomplished nearly 16 %.

**Tab. 3: AHP/ANP Comparison of computed priority weights**

| Field | AHP | ANP |
|---|---|---|
| Organization A<br>*Českáspořitelna, a.s.* | 53,54 % | 51,26 % |
| Organization B<br>*Komerčníbanka, a.s.* | 30,65 % | 32,97 % |
| Organization C<br>*UniCreditbank Czech Republic, a.s.* | 15,82 % | 15,77 % |

Source: own computations

## Conclusion

The main goal of this paper is connected with the evaluation of CSR activities in the selected banking organizations based on the AHP method and compared with the ANP approach. Nowadays, various methods such as external audits, certifications, quality marks, sustainability indices or non-financial reporting initiatives could be appropriately used for a systematic CSR assessment but they differ in a complexity and are focused on specific areas where the special requirements have to be met. A solution of multiple-criteria decision-making tasks based on hierarchical or network decompositions and paired comparisons should be a helpful managerial toolfor decision making or benchmarking and bring reliable sources for suitable CSR evaluation procedures.

The application of the AHP/ANP methods in CSR evaluation topics is demonstrated on a sample consisted of the three organizations: *Českáspořitelna, a.s.* (Organization A), *Komerčníbanka, a.s.* (Organization B) and *UniCreditbank Czech Republic, a.s.* (Organization C).Preferences of the criteria and the sub-criteria included in that MADM task were appraised by an expert, while the CSR performance of each banking organization was considered by the author´s opinionsbased on information got from a content analysis of current internet presentations, CSR reports and other available publications and surveys. According to the results of both methods, the CSR fields and organizations were ordered similarly. As for the order of sub-criteria, only minor differences were found out. Concerning preferences distribution the most significant variation was observed within the CSR sub-criteria. According to the AHP/ANP distributive mode synthesis,*Českáspořitelna, a.s.*, representing a firm promoting a successful responsible approach, achieved the best results within the sample. *Komerčníbanka, a.s.* took a second place and it was followed by *UniCreditbank Czech Republic, a.s*.Although the priority weights computed using the AHP and ANP methods were very similar, there is still an opportunity to explore the relations and interconnections among the CSR components. In that case a group of experts should be asked to participate.

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