COMPARISON OF DEMATEL AND WINGS METHOD IN FIELD OF CORPORATE SOCIAL RESPONSIBILITY

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Abstract

Corporate Social Responsibility has become an integral part of many organizations. The CSR concept can be generally understood as a willing obedience of responsible behaviour and social engagement at regional, state and global level, as well. A broad thematic range of the CSR concept interconnecting a large quantity of scientific fields and expert opinions leads to a terminological disunity resulting in many various definitions. An exact measurement is a very questionable and difficult task. The main goal of this paper is to compare applications of DEMATEL and WINGS method used for the CSR performance measurement, identify possible relations among selected CSR activities from a managerial point of view according to results of those methods and determine key factors of successful CSR strategy for banking organizations. Both methods belong to multiple-attribute decision-making methods (MADM methods) that are based on a usage of pairwise comparisons. Results show that the economic field is the most important factor, while safety, ethical codes, ecological innovations, management and certifications, and employee welfare belong to the key CSR criteria.

Key words: Corporate Social Responsibility, multiple-criteria decision making, DEMATEL, WINGS

JEL Code: M14, L21

Introduction

In 1953 the American economist Howard R. Bowen (Horrigan, 2010) introduced his book named Social Responsibilities of the Businessman that served as a source of inspiration for the title of the special study named Corporate Social Responsibility (in short CSR). Specialized research centres focusing on the exploration of this dynamically developing field have gradually emerged. Various institutions supporting and promoting the sustainable and responsible entrepreneurship have been established worldwide. Owing 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 to compare results of DEMATEL and WINGS method applied in the field of CSR in order to identify possible relations among selected CSR criteria from a managerial point of view and determine key factors of a successful CSR strategy for banking organizations.

1 Theoretical basis of Corporate Social Responsibility

What CSR means nowadays has been examined and presented in literature reviews such as Garriga and Melé, 2004; Lee, 2008; Lindgreen and Swaen, 2010; Aguinis and Glavas, 2012. Based on a content analysis of 37 CSR definitions according to Dahlsrud (2008), stakeholders, voluntariness, economic, environmental and social dimensions are considered to be characteristic features of the CSR concept. Contemporary authors such as Coombs and Holladay (2012), Horrigan (2010), Kunz (2012) are familiar with a triple-bottom-line concept presented also by the European Union that includes three basic domains 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

Weighted Influence Non-linear Gauge System method (in short WINGS) is in fact an extended and revised form of DEMATEL method. In comparison with DEMATEL, in case of WINGS method importance of criteria is taken into consideration and numerically appraised. Subsequent mathematical procedure is similar to DEMATEL (Michnik, 2013).

2.1 DEMATEL method

Decision-making Trial and Evaluation Laboratory method (in short DEMATEL) was originally developed by Fontela and Gabus (1976) to analyse complex problems. It is a mathematical procedure suitable for a determination of interrelations between criteria (factors) and subsequently it is used for an identification of a subset containing the effective

criteria (factors) only. In comparison with the traditional methods such as Analytic hierarchy process assuming that criteria are independent, DEMATEL focuses on a depiction of causal relations among the elements of a considered system through an impact – relation map (IRM) and an evaluation of influences between criteria (Klozíková and Dočkalíková, 2014). DEMATEL is based on pairwise comparisons and is comprised of these following steps:

Firstly, a group of *m* experts are supposed to assess a degree of a direct influence of criterion *i* on criterion *j* denoted as $x_{i\,j}$ using the scale $\langle 0;4 \rangle$. Value 0 means "no influence", number 1 goes with "an insignificant influence", 2 "a medium influence", 3 "a strong influence" and 4 "a very strong influence". Assuming *n* criteria, an *n x n* non-negative matrix is constructed for each expert and is denoted as $X^k = \left[x_{ij}^k\right]$, where *k* is a number of experts participating in evaluation processes, while $1 \le k \le m$. Thus, X^1, X^2, X^3, …, X^m are the matrices from *m* experts. To aggregate opinions from *m* experts, the average matrix $A = \lfloor a_{ij} \rfloor$ has to be computed according to a formula:

$$a_{ij} = \frac{1}{m} \sum_{i=1}^{m} x_{ij}^k \,. \tag{1}$$

Secondly, the normalized initial direct – relation matrix $D = \lfloor d_{ij} \rfloor$ has to be calculated:

$$D = \lambda \times A, \text{ where} \tag{2}$$

$$\lambda = \min\left[\frac{1}{\max\limits_i \sum_{j=1}^{n} |a_{ij}|}, \frac{1}{\max\limits_j \sum_{j=1}^{n} |a_{ij}|}\right]. \tag{3}$$

Thirdly, the total relation matrix T has to be derived from the equation (4), where I represents the identity matrix and D is the direct – relation matrix.

$$T = D(I - D)^{-1} \tag{4}$$

The sum of rows and the sum of columns in the total relation matrix T are represented by vectors *r* and *c*:

$$r = [r_i]_{n\times 1} = \left\lfloor \sum_{j=1}^{n} t_{ij} \right\rfloor_{n\times 1}, \tag{5}$$

$$c = \left[c_j\right]_{1\times n} = \left\lfloor \sum_{i=1}^{n} t_{ij} \right\rfloor_{1\times n}, \tag{6}$$

where r_i denotes the sum of *i*-th row in the matrix T and shows a total (direct and indirect) effect of criterion *i* on the other criteria. Similarly, c_j denotes the sum of *j*-th column in the matrix T and shows a total (direct and indirect) effect received by criterion *j* from the other criteria. In addition, when *i* = *j*, $(r_i + c_j)$ denotes the total effects given and received by

a criterion *i*. It indicates the degree of importance that element *i* plays in the whole system. On the other hand, $(r_i - c_j)$ means the net effect that criterion *i* contributes to the system. If $(r_i - c_j)$is positive, element *i* is a net cause that affects the other criteria. If $(r_i - c_j)$is negative, element *i* is a net receiver (result) that is influenced by the other criteria (Shieh, Wu and Huang, 2010; Tzeng, Chiang and Li, 2007).

Fourthly, a threshold value α has to be set in order to filter out minor effects. In doing so, only the effects exceeding the threshold value will be chosen and shown in a diagraph called IRM. The threshold value could be either estimated by the experts or computed as the average of the elements in matrix T (Lee et al., 2013).

2.2 Utilization of DEMATEL and WINGS method in Corporate Social Responsibility

First a hierarchical network respecting the main goal connected with a determination of key factors of a successful CSR strategy was created. Fields were chosen according to the triple-bottom-line definition of CSR while each one was specified by three criteria. An overview of the elements together with short descriptions is provided in Tab. 1.

Tab. 1: Overview of selected CSR fields and criteria

C1: ECONOMIC FIELD	**C11:** Safety	*Overall safety, socially responsible investing, distribution of information for customers and clients*
	C12: Transparent reporting	*Regular publication of financial and non-financial reports, audit of these reports*
	C13: Ethical codes	*Usage of ethical codes, updating and ways of their forming*
C2: ENVIRONMENTAL FIELD	**C21:** Ecological innovations	*Support of innovative ideas and projects, R&D*
	C22: Recycling	*Separation of waste materials, waste management, waste minimization*
	C23: Eco management and certifications	*ISO 14001 and ISO 14004 norms, various quality labels, environmental audits, high-quality products and services*
C3: SOCIAL FIELD	**C31:** Employee welfare	*Employee benefits, flexible working hours, ethical lines, above-standard medical care, ergonomically friendly workspace, etc.*
	C32: Corporate donations	*Financial and non-financial corporate donation, corporate foundations and endowment funds*
	C33: Employee volunteering and engagement	*Support of employee volunteering projects and payroll giving initiatives*

Source: Coombs and Holladay (2012); Horrigan (2010); Kunz (2012)

The next step was to compare pairwise and evaluate by using a scale from 0 to 4 possible relations between the CSR fields (C1 – C3) and then relations between groups of the criteria (C11 – C13; C21 – C23; C31 – C33) together with importance of each field and criterion. To overcome a subjectivity following from an individual expert´s opinion a group of five academics and non-academic was involved in a relations and importance appraisal of the elements. The research was carried out during years 2015 and 2016.

3 Results

For the CSR fields (C1 – C3) the threshold values α_D = 0.1676 and α_W = 0.1698 were computed. According to $(r_i + c_j)$ values meaning a sum of given and received effects (an overall importance) the CSR fields can be ordered as follows: C1 > C3 > C2. The economic field (C1) is considered to be the most important one, while the environmental field (C2) is the least important field in that case. Based on $(r_i - c_j)$ values the environmental field (C2) and social field (C3) are net causes, whereas the economic field (C1) is a net receiver. For detailed information see Tab. 2 and Tab. 3.

According to the results of both methods, the economic field (C1) and social field (C3) are mutually dependent. It means they affect each other. What is more, the environmental field (C2) influences the economic criteria (C1). Based on calculations of DEMATEL method the social field (C3) is in relation with the environmental criteria (C2). According to WINGS method, there are significant loops at the economic (C1) and social field (C3).

Tab. 2: Matrix T for CSR fields and overview of direct and indirect effects - DEMATEL

CSR Fields	*Economic*	*Environmental*	*Social*	$(r_i + c_j)$	$(r_i - c_j)$
Economic	0.0886	0.1364	0.2812	1.1173	-0.1049
Environmental	0.2476	0.0449	0.1478	0.8236	0.0569
Social	0.2748	0.2020	0.0848	1.0755	0.0479

Source: own computation

Tab. 3: Matrix T for CSR fields and overview of direct and indirect effects - WINGS

CSR Fields	*Economic*	*Environmental*	*Social*	$(r_i + c_j)$	$(r_i - c_j)$
Economic	0.2801	0.0898	0.2171	1.2488	-0.0749
Environmental	0.1782	0.1236	0.0916	0.7439	0.0430
Social	0.2036	0.1371	0.2071	1.0635	0.0319

Source: own computation

For the economic field (C11 – C13) the threshold values α_D = 0.1636 and α_W = 0.1662 were calculated. According to $(r_i + c_j)$ values for DEMATEL method depicting an overall importance, the economic criteria can be ordered as follows: C11 > C13 > C12. For WINGS method the economic criteria can be ordered like this: C11 > C12 > C13. The criterion concerning overall safety (C11) is considered to be the most important one. The positions of the remaining criteria are interchanged. Based on $(r_i - c_j)$ values ethical codes (C13) are net causes, whereas the criterion dealing with safety (C11) is a net receiver. The criterion linked to transparent reporting (C12) is appraised differently. In accordance with DEMATEL computations it is a net receiver, whereas for WINGS method it comes out as a net cause. For detailed information see Tab. 4 and Tab. 5.

The results of DEMATEL method indicates a strong mutual dependency among the selected criteria. Safety (C11) is in relation with transparent reporting (C12) and ethical codes (C13), and vice versa. What is more, ethical codes (C13) affects a level of transparent reporting initiatives (C12). According to WINGS method there are significant loops at the criteria dealing with an overall safety (C11) and transparent reporting (C12).

Tab. 4: Matrix T for economic criteria and overview of direct and indirect effects - DEMATEL

Economic field	*C11*	*C12*	*C13*	$(r_i + c_j)$	$(r_i - c_j)$
Safety (C11)	0.0890	0.1675	0.1885	1.1395	-0.2494
Transparent reporting (C12)	0.2856	0.0509	0.0914	0.8634	-0.0076
Ethical codes (C13)	0.3198	0.2170	0.0624	0.9415	0.2570

Source: own computation

Tab. 5: Matrix T for economic criteria and overview of direct and indirect effects - WINGS

Economic field	*C11*	*C12*	*C13*	$(r_i + c_j)$	$(r_i - c_j)$
Safety (C11)	0.2309	0.1256	0.1443	1.1924	-0.1910
Transparent reporting (C12)	0.2242	0.1738	0.0592	0.9122	0.0021
Ethical codes (C13)	0.2366	0.1557	0.1458	0.8873	0.1889

Source: own computation

For the environmental criteria (C21 – C23) the threshold values α_D = 0.1625 and α_W = 0.1654 were calculated. According to $(r_i + c_j)$ values for DEMATEL method depicting an overall importance, the environmental criteria can be ordered as follows: C22 > C21 > C23. For WINGS method the environmental criteria can be ordered like this: C21 > C22 >

C23. The criterion dealing with environmental management and certifications (C23) is the least important criterion in that case. The positions of the remaining criteria are interchanged. Based on $(r_i - c_j)$ values environmental innovations (C21) together with eco management and certifications (C23) are net causes, whereas recycling (C22) is a net receiver. For details see Tab. 6 and Tab. 7.

According to the results of both methods, ecologic innovations (C21) are in relation with recycling initiatives (C22), while environmental management and certifications (C23) have an influence on the level of eco innovations (C21). The results of DEMATEL method shows a mutual dependency among ecologic innovations (C21) and eco management and certifications (C23). According to WINGS method, loops are visible at each environmental criterion.

Tab. 6: Matrix T for environmental criteria and overview of direct and indirect effects - DEMATEL

Environmental field	*C21*	*C22*	*C23*	$(r_i + c_j)$	$(r_i - c_j)$
Eco innovations (C21)	0.0574	0.3611	0.1424	0.9707	0.1511
Recycling (C22)	0.1215	0.0678	0.1806	1.0419	-0.3021
Eco management and certifications (C23)	0.2309	0.2431	0.0574	0.9117	0.1511

Source: own computation

Tab. 7: Matrix T for environmental criteria and overview of direct and indirect effects - WINGS

Environmental field	*C21*	*C22*	*C23*	$(r_i + c_j)$	$(r_i - c_j)$
Eco innovations (C21)	0.2428	0.2642	0.0908	1.0892	0.1065
Recycling (C22)	0.0809	0.1833	0.1255	0.9926	-0.2130
Eco management and certifications (C23)	0.1676	0.1552	0.1784	0.8960	0.1065

Source: own computation

For the social criteria (C31 – C33) the threshold values α_D = 0.1650 and α_W = 0.1656 were computed. According to $(r_i + c_j)$ values for DEMATEL method depicting an overall importance, the social criteria can be ordered as follows: C33 > C32 > C31. For WINGS method the social criteria can be ordered like this: C31 > C32 > C33. Corporate donations (C32) are placed on the second place. The positions of the remaining criteria are interchanged. Based on $(r_i - c_j)$ values employee welfare (C31) is a net cause, whereas corporate donations

(C32) and employee volunteering programs (C33) are net receivers. For detailed information see Tab. 8 and Tab. 9.

Based on the results of both methods, employee welfare (C31) affects the level of corporate donations (C32) and employee volunteering (C33). Corporate donations (C32) and employee volunteering programs (C33) are mutually dependent on each other. It means they are in a reciprocal relation. According to WINGS method, there are significant loops at the criteria dealing with employee welfare (C31) and corporate donations (C32).

Tab. 8: Matrix T for social criteria and overview of direct and indirect effects - DEMATEL

Social field	*C31*	*C32*	*C33*	$(r_i + c_j)$	$(r_i - c_j)$
Employee welfare (C31)	0.0531	0.2368	0.2669	0.8847	0.2289
Corporate donations (C32)	0.1073	0.0688	0.2433	0.9789	-0.1400
Employee volunteering (C33)	0.1675	0.2538	0.0872	1.1058	-0.0890

Source: own computation

Tab. 9: Matrix T for social criteria and overview of direct and indirect effects - WINGS

Social field	*C31*	*C32*	*C33*	$(r_i + c_j)$	$(r_i - c_j)$
Employee welfare (C31)	0.2221	0.1727	0.1902	1.0040	0.1659
Corporate donations (C32)	0.0755	0.2005	0.1740	1.0026	-0.1025
Employee volunteering (C33)	0.1214	0.1794	0.1547	0.9743	-0.0634

Source: own computation

Conclusion

The main goal of this paper is to compare results of DEMATEL and WINGS method applied in the field of CSR in order to identify possible relations among selected CSR criteria from a managerial point of view and determine key factors of a successful CSR strategy for banking organizations. First, a hierarchical network respecting the main goal was created. Fields were chosen according to the triple-bottom-line definition of CSR while each one was specified by the three sub-criteria. Then a group of five academics and non-academic was asked to rate possible relations among the elements.

As Michnik (2013) mentions in WINGS method importance of each element (criterion) is taken into consideration that may result in a different final ranking of criteria and identified relations in comparison with results of DEMATEL method. Different ranking of sub-criteria was found out in the economic, environmental, and social field. According to the

results of both methods, categorization of net causes and net results was the same except the economic criterion connected with transparent reporting (C12).

Based on the results of both methods, the economic field (C1) is considered to be the most important factor according to a sum of given and received effects at the first hierarchical level. What is more, the economic field is a net receiver influenced by the rest of the CSR fields. At the second hierarchical level the criteria concerning safety (C11) and ethical codes (C13) is regarded to be the most important economic sub-criteria. Within the environmental field ecological innovations (C21) that are also net causes play an important role. Finally, the criterion connected with employee welfare (C31) represents the most important element from the social field because it is a net cause. A mutually dependent relation exists among criteria dealing with corporate donations (C32) and employee volunteering programs (C33).

According the results of both methods safety, ethical codes, ecological innovations, management and certifications, and employee welfare represent key factors of a successful CSR strategy for banking organizations. It is assumed that the obtained results might be different for other business sectors (e.g. for manufacturing, industrial or educational organizations different relations might by determined). For a further analysis it is recommended to explore differences between business sectors in the Czech Republic and the other countries as well.

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