Managerial Decision Making in Geopolitically Turbulent Environments

Gawlik, Remigiusz

Cracow University of Economics

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MANAGERIAL DECISION – MAKING IN GEOPOLITICALLY TURBULENT ENVIRONMENTS

ABSTRACT

The presented paper is a presentation of final results of research led throughout past years on a group of Polish and international SME's. The essential aim was the elaboration of a decision – making model including both qualitative and quantitative factors that influence decision – making processes. Most focus has been put on geopolitical determinants of international companies' development. In order to narrow the research field, a further limitation has been made in the type of undertaken solutions. This resulted in focusing on managerial rather than strategic decisions, although long – term strategic planning still can be enhanced through application of proposed method. The research methodology has been based on Analytic Hierarchy Process applied for assessment of individual and collective utility of various indexes describing the actual economic situation and short – term prospects of enterprises operating locally (inside Poland) and internationally. The presented final stage of research draws attention to expert evaluations of 6 professional experts carefully chosen from a group of 31 skilled managers interviewed in preliminary research phase. The study ends with a proposal of a qualitative – quantitative decision - making model anticipating geopolitical factors in order to improve the quality of managerial decision making in international enterprises.

Key Words: *Analytic Hierarchy Process, Geopolitical Factors, Development Indexes, Decision Making Model*

INTRODUCTION

The development of international companies depends on multiple elements. The character of some of them is strictly mathematical, though measurable. This group consists mainly of economic and statistical indexes, such as level of cash on bank account, capitalization, equity price, number of clients, general level of income, investment to income ratio, level of employment, Parts Per Million (PPM), return on capital, floating assets level or operating profit (Earnings Before Interest and Taxes – EBIT). Other determinants bear a quantitative nature – they are easy to observe and define, but hardly convertible into numbers. This last feature makes their availability for comparisons or model applications very limited, none the less necessary at consecutive phases of strategic planning. Product life cycle, product diversification, flexibility, innovativeness, structure of backlog of orders, survival ratio and geographical range of activity belong to this group. Omitting quantitative or qualitative factors at managerial decision – making processes seems to be an unfounded simplification. At the same time this duality of characteristics of decision - making determinants poses significant problems: how shall managers weight the influence of quantitative factors? How should they evaluate the importance of qualitative determinants of their enterprises' development?

Broad studies of economic literature showed little availability of research on application of mathematic tools allowing the integration of both qualitative and quantitative factors into a single model, easily applicable for enterprise managers. Their choice becomes even more restricted when searching for decision – making models that incorporate possible geopolitical scenarios. The presented paper is an attempt of filling this gap with a proposal of

a ready – to – use solution based on Analytic Hierarchy Process (AHP) methodology and Expert Choice software – a tool for AHP evaluations available on the market.

1. RESEARCH METHODOLOGY AND FACTOR SELECTION

The research thesis says that "*Identification and description of relations between geopolitical processes and development of international companies leads towards possibly optimal decision making in strategic and tactical fields*". In other terms author's concern is the influence of geopolitical determinants of international companies' on their decision – making processes. The determinants in question are factors describing operating, host – country and global environments of international companies. This concept by Deresky (2010), called the Open Systems Model and dividing international company's business environment into three mentioned layers, is the basis of the research methodology. The segmentation base comes from each layer's distance to the enterprise in question. For the purposes of present research an initial assumption has to be made: global environment is treated as constant and in further analysis will be omitted as too turbulent and therefore unpredictable. Any economic forecasting can be performed for short- and middle – time periods only, due to the magnitude of forecasting faults coming from non - linear character of global environment and its big exposition to external shocks. The implications of 2008 global financial crisis seem to be the best example, when various prognostics and development plans of various industry branches had to be deeply revised, despite their large distance to banking sector touched by the crisis directly. For further explanations please refer to Gawlik (2007).

Multidimensional decision – making problems, such as the one analyzed here, require the application of systematic processes. Ogryczak (2006) distinguishes four main stages of such a process:

1. Problem definition – initial observation of actual state of arts, recognition that changes are needed and deeper analysis leading to articulation of expected final effect. In discussed research we will be searching for optimal combination of factors describing the development level of international enterprises in order to achieve possibly optimal decision – making results in geopolitically turbulent environments.
2. Problem formulation – identification of key elements of decision process in question, i.e. decision – maker, decision alternatives, external parameters, limitations of alternative decisions. Here decision – makers are 31 expert managers in preliminary factors selection phase and six carefully chosen experts in AHP evaluation phase. Decision alternatives are seven factors describing the development level of international enterprises while external parameters and limitations correspond to determinants of operating and host – country environments (or geopolitical processes). Methods of factors selection have been described in section 2.
3. Choice of a decision from available alternatives – main part of decision – making, very sensitive to subjective evaluations of the decision – maker. The proposed model aims at structuring and formalizing the decision – making in order to achieve a possibly optimal managerial decision and minimize the consequences of mistakes.
4. Implementation and control – final stage that allows implementing the results of decision – making into reality. Monitoring of implementation results, too often omitted in managerial praxis, brings important feedback that allows to make necessary corrections or even to start another decision – making cycle.

The research process consists of 3 phases – initial factor selection, preliminary factor selection and AHP evaluation. Initial factor selection consists of direct interviews with randomly chosen managers of internationally operating companies from top, middle and operational managerial levels. Author's main concern were their decision – making habits, % of wrong decisions and willingness of using tools providing backup in decision – making processes. The questioning resulted in reducing initial 100 indexes of development of international enterprises to 18. Preliminary factor selection phase meant extracting 7 most useful indexes out of the 18 based on responses to a paper questionnaire by 31 expert managers. The questionnaire covered following issues: region of operation of analyzed companies; years of experience on the market; legal form; territorial coverage (regional, national, international, global); percentage of foreign capital involvement; number of employees and employment structure (size of employment, type of contract, language skills, education); income from local, regional, international and global markets; level of profit / loss in past time periods; willingness of consulting services use; which weights should be attributed by company's management to particular indexes describing the actual economic situation and

short – term prospects of respondent's business at times of crisis; how would their preference towards indexes' weights change in a situation of economic prosperity? 7 indexes obtained at this stage are flexibility, level of income, number of clients, survival ratio, operating profit, product diversification and structure of backlog of orders.

Classical Delphi method has been applied for data gathering at preliminary factor selection phase. Literature studies provide various definitions of Delphi. Adler & Ziglio (1996) understand it as "*...a structured process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires interspersed with controlled opinion feedback*". Duval, Fontela and Gabus (1975) underline the value of expert opinions for decision – makers in a situation of permanent lack of full scientific knowledge in their daily routine. Helmer (1977) adds that "*Delphi represents a useful communication device among a group of experts and thus facilitates the formation of a group judgment*". A modified Pareto – Lorenz Diagram has been chosen for presentation and analysis of acquired data. According to Szumnarska (1996) "*The Pareto – Lorenz diagram [...] is applied to identify and measure the importance of analyzed issues. Only these problems will be identified, which although being in minority towards the rest (20%) bear a dominant influence on analyzed issue (80%).*" The Pareto – Lorenz rule applied to the present study can be transposed into a proposal to managers to use only these indexes of enterprise's economic condition that bring highest probability of optimal decision. Analyzing a bigger number of factors – including these less relevant – lowers the efficiency and will not bring higher decisions quality.

AHP evaluation phase – attribution of weights to final 7 indexes via application of Analytic Hierarchy Process by 6 expert managers obtained through Stratified Random Sampling (SRS) from 31 experts – respondents at preliminary factor selection phase. Bartlett's, Kotrlik's and Higgins' (2001) SRS principles stating that "*population's division into strata has to be made in such a way that every element belongs to one strata only, but at least to one of them. Various strata have to be uniform and show some significant differences between each other*" have been maintained. This method allowed the division of entire sample population into strata (layers). Division criteria match Ackoff's (1999) levels of management: Top management (strategic) – enterprise's managerial board, making strategic, tactical and operational decisions, controlling all functions of the real sphere; Middle management (tactical) – managers of most important organizational cells, making tactical and operational decisions and supervising most of real sphere functions; Operational management (operational) – directors of operational cells, their decisions have an operational character and in most cases touch one specialized function of real sphere.

Two independent expert groups have been obtained via use of SRS method. First group consists of 3 managers from top (strategic) managerial level, second of 3 managers from middle (tactical) managerial level. Focusing on two highest managerial levels only (strategic and tactical) seems justified by the fact that the presented research aims at anticipating geopolitical processes when making managerial decisions, which is less likely to happen at lower managerial positions, such as the operational level. Strategic level experts: CEO of a fast growing international trade company that adopted franchise as development method, based in 100% on Polish capital and operating in food industry; CEO of international consulting company specialized in emerging markets, with mixed American – British capital, also issuing its own market analyses; Director of Board of Managers of a culture – tourism institution registered under legal form of LTD, noted on UNESCO list of World Cultural Heritage, with vast experience in international management and enterprise debuts on stock exchange markets. Tactical level experts: Administrative Manager for Central- and Eastern Europe (CEE) working for an international corporation – leader in chemistry branch; Chief of Internal Audit and Controlling Office of biggest CEE oil trust with professional experience acquired at Wall Street; Managing Director of an independent record label, radio station (4 channels) and promotional agency with business cooperation with companies located in 64 countries.

All methods above can be understood as preparative steps for crucial part of presented research, which has been achieved through use of Analytic Hierarchy Process. AHP is a tool enhancing decision – making processes. Its application seems to be the most reasonable in situations when decision problems are characterized by high level of complexity. AHP can be applied only in cases when problem structure can be presented as hierarchical and where upper hierarchy elements do not interact nor influence lower hierarchy elements (Saaty 2001). In frames of AHP method experts from both managerial groups have been asked to perform pair – wise comparisons of suitability of 7 indexes determining the operational and host – country environment of international companies (extracted at former research stages) for decision – making purposes. Separate research has been performed on each managerial level (strategic, tactical). The outcomes of the research in question have been presented below.

2. THEORETICAL ASPECTS OF MODEL DESIGNING

All models, including decision – making ones, are simplifications of multidimensional reality. As such they can only represent chosen aspects of analyzed problems. Ogryczak distinguishes following types of models:

- Verbal (descriptive and iconic) – verbal models describe model's features and interdependencies, iconic models use graphical elements to show some links directly, but without conformity with any scale.
- Analog (physical, graphical) – analog models preserve important features of original objects, but their utility for decision – making seems much lower than the one of graphical version.
- Symbolic (formal, mathematical) – symbolic models are a formal notation of chosen features and interdependencies with use of abstract symbols and relations. Mathematical models can be further divided into static (omitting time span) and dynamic (multidimensional, including changes and decision – making results after time periods). Stochastic and deterministic – stochastic models anticipate the uncertainty of data, results and risk management of taken decisions, whereas deterministic models omit all uncertainty aspects treating all parameters and results of the model as determined values (Ogryczak 2007).

Last group of models shall acquire more interest in frames of current analysis. When choosing an appropriate model type for a given decision – making problem always same concern arises: whereas statistical models are easier to apply, they can be only used in situations when decisions cover short time horizons only. Dynamic models seem to be more appropriate then, but at the same time they are much more complicated and difficult to apply. Same situation is valid when talking about deterministic and stochastic models. Whereas first ones can be easily applied in stable environmental conditions and short time horizons, only the second group provides inclusion of enough parameters (i.e. changes in time) in order to minimize the uncertainty of decision – making. At the same time they are way more complicated both in elaboration and implementation phases.

Besides a large number of criteria that should be taken into account when making decisions and a low level of problem structuring one of the main problems that arise when elaborating a mathematical decision – making model is the question of time span of performed analysis. This concern includes not only "freshness" of gathered data, but also time restrictions when obtaining and analyzing the results. Therefore a striking contradiction arises: managers need fast and effective decision – making tools, but at the same time they would like their models to be based on simplified criteria, that just need to omit some of problem's interdependencies and features. Last, but not least – the so called human factor. Ogryczak (2009) indicates an outstanding difficulty in modeling manager's preferences basing on his/her psychological features. The author wants to add another issue arising at final stage of problem solving – alternative choice and its costs. In order to obtain equal chances, at first instance decision alternatives should be easily comparable between each other, which seems to be a major difficulty in most descriptive models. Finally, at most decision – making processes it seems reasonable to search for a compromise between simplified and complicated types of models in order to acquire a model close enough to complex economic reality, but limited enough to make its application and outcome analysis possible. The author believes that some of these problems can be solved by applying instruments that transform quantitative decision criteria into qualitative ones, such as the Analytic Hierarchy Process.

3. DECISION – MAKING MODEL PROPOSAL

We are building a symbolic mathematical decision – making model composed of two parts: factual- and preference sub – models. The factual sub – model represents all interdependencies inside decision problem's environment, whereas the preference sub – model shows its utility only later, when analyzing decision process' outcome and building possible scenarios. Ogryczak (2009) proposes 3 phases of symbolic model designing: identification of model variables; definition of dependencies between variables; determining of types of variables and their interrelations. Consecutive steps of the design process together with assigned determinants of its geopolitical environment have been presented below:

Identification of model variables:

- External parameters:
  - Deterministic: $A = \{a_i\}, i = \{1,2,...5\}; B = \{b_l\}, l = \{1,2,...6\}$ – determinants of operating environment a_i (legal regulations, culture in organizational aspect, skills, social responsibility, ethics); determinants of host – country environment b_l (economic-, political- and technological factors, culture in individual aspect, subsidiary & host – country interdependence); k – coefficient representing a general number of wrong managerial decisions (% value taken from interviews at initial factor selection phase, empirically between 10% and 20%); y_O, y_H – total number of managerial decisions taken inside operating- and host - country environment (respectively). External parameters are significant, but out of decision maker's control.
  - Probabilistic: d_O, d_H – external disturbance coming from operating- or host - country environment;
- Decision variables: $X = \{x_j\}, j = \{1,2,...7\}$ – indexes describing the development level of international enterprises (flexibility, level of income, number of clients, survival ratio, operating profit, product diversification, structure of backlog of orders). Under control of decision – maker.
- Variables of state:
  - Main function: $Y: y = f(x)$ – final effect of decision – making in form of managerial decisions or more precisely an aggregation of all possible combinations of decision variables together with their weights. Obtained decision – making function can further become subject to optimization.
  - Main function's components: C_O, C_H – correct decisions taken in operating- or host – country environment (respectively); W_O, W_H – wrong decisions (*per analogiam*).

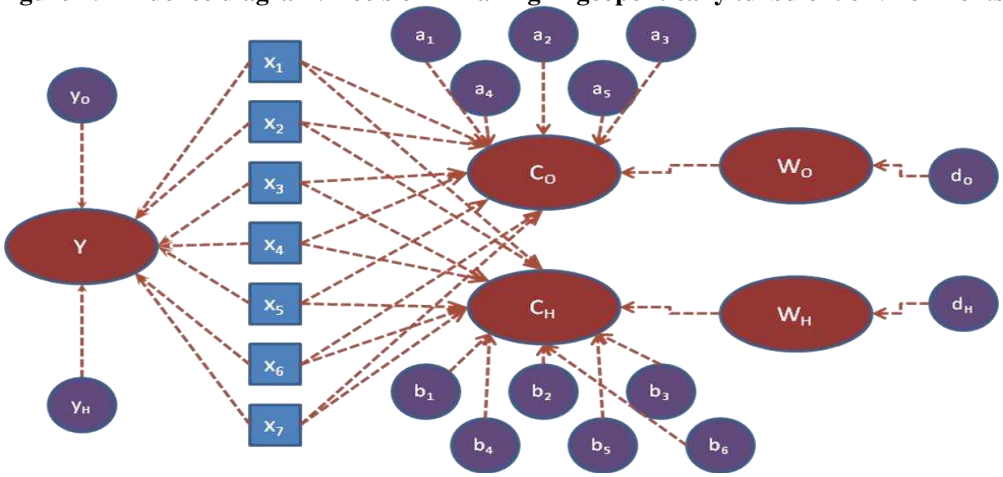
Definition of dependencies between variables:

- Functions – a correct choice of weights of indexes (decision variables) allows to anticipate changes in environmental factors (external parameters) and achieve an optimal decision – making level (state variables);
- Relations – not all dependencies between model variables can be represented as functions (values of some variables can be attributed to more than one variable or one set of group of variables). In such cases discussed phenomena become relations – given variables can represent deterministic or probabilistic interdependencies.

Determining of types of variables and their interrelations (possibly in form of an Influence Diagram – Fig. 1):

- Deterministic – straight lines on Influence Diagram;
- Probabilistic – presented with use of broken lines.

Figure 1: Influence diagram: Decision – making in geopolitically turbulent environments



Source: own elaboration

The dependency between random state variable representing a managerial decision and a decision variable representing weights of indexes to rely on could be named as probabilistic, because of possibility of sudden changes in external variables, but as this probability is very low, we assume this relation to be deterministic. Thus the proposed decision – making function can be formulated as follows: a variable of state representing a decision taken by a manager of an international enterprise is a function of environmental determinants (external parameters of operating- and host - country environments) and a proper choice of weights of indexes describing the development level of this enterprise (decision variables). In mathematical notation this sentence takes the following form:

$$Y = y_O\,(C_O - W_O) + y_H\,(C_H - W_H) \qquad \text{[Eq. 1]}$$

Eq. 1 – a possibly optimal managerial decision is a sum of weights of all correct decisions (C_O) minus all wrong decisions (W_O) taken inside operating environment ($..O$) multiplied by their sum (y_O) plus weights of all good (C_H) minus all wrong (W_H) decisions taken inside host - country environment ($..H$) multiplied by their sum (y_H). The weights can be obtained in a qualitative - to - quantitative transposition process through application of AHP method.

$$C_O = \sum_{i,j=1}^{n} a_{ij} x_j \text{ , where } i = \{1,2,...5\},\ j = \{1,2,...7\} \qquad \text{[Eq. 2]}$$

Eq. 2. – a correct decision taken inside the operating environment (C_O) is a sum of weights of all arithmetic products of determinants of operating environment (external parameters a_{ij}) and weights of indexes describing the development level of an international enterprise (decision variables x_j).

$$W_O = k\,d_O \qquad \text{[Eq. 3]}$$

Eq. 3. – a wrong decision taken inside the operating environment (W_O) is the effect of a random external disturbance coming from this environment (d_O) augmented by an empirically determined coefficient k representing a general number of wrong managerial decisions. Occurrence of disturbance cannot be foreseen due to its probabilistic nature.

Equations for host – country environment can be deducted *per analogiam* and have been presented below:

$$C_H = \sum_{l,j=1}^{n} b_{lj} x_j \text{ , where } l = \{1,2,...6\},\ j = \{1,2,...7\} \qquad \text{[Eq. 4]} \qquad \& \qquad W_H = k\,d_H \qquad \text{[Eq. 5]}$$

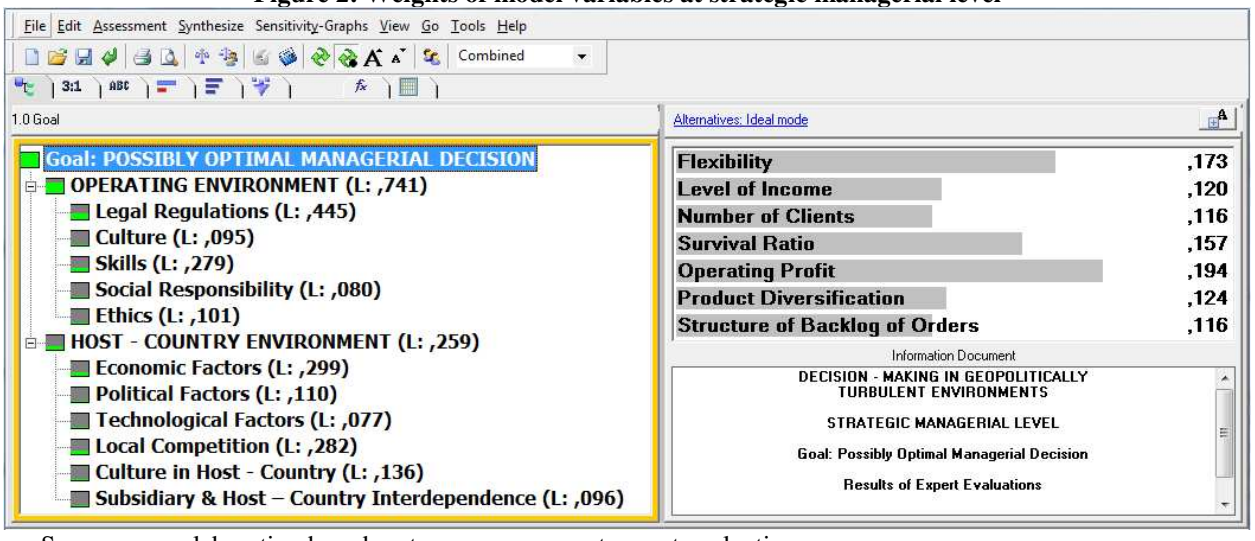
Eq. 6 – function describing the decision – making process in geopolitically turbulent environments under adapted criteria (determinants of operating- and host - country environment):

$$Y = y_O\left(\sum_{i,j=1}^{n} a_{ij} x_j - k d_O\right) + y_H\left(\sum_{l,j=1}^{n} b_{lj} x_j - k d_H\right), \text{ where } i = \{1,2,...5\};\ l = \{1,2,...6\};\ j = \{1,2,...7\}$$

[Eq.6]

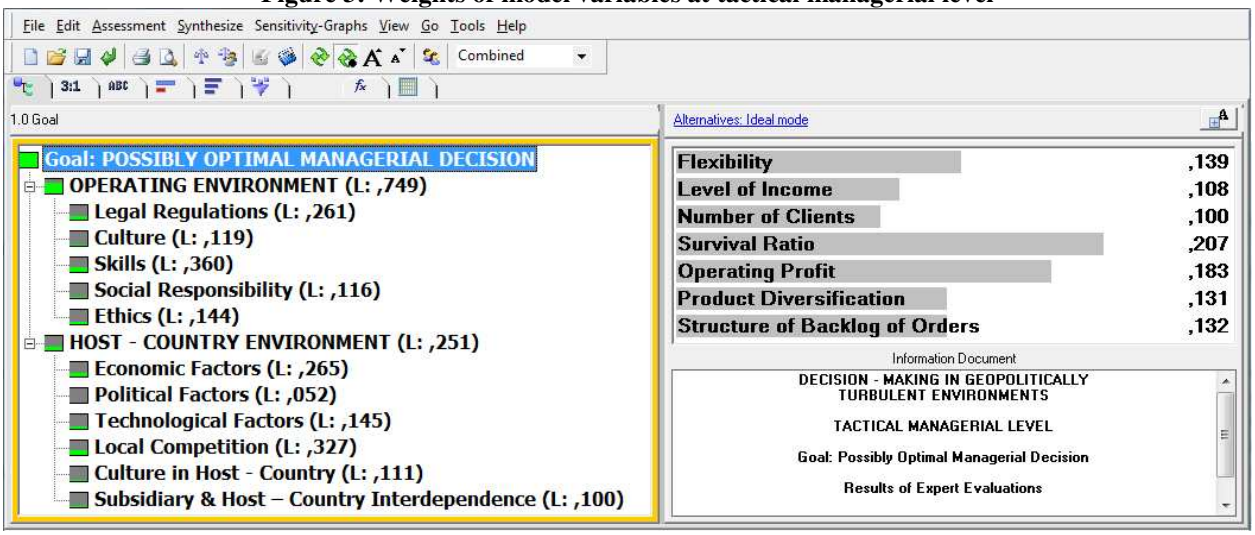
All model variables from Eq. 6 are of qualitative nature. Analytic Hierarchy Process allows creating a hierarchy of initially equivalent criteria through expert evaluations. Their numerical form is nothing but transposition of qualitative criteria into quantitative, thus measurable ones, which allows their incorporation into proposed decision – making model. Obtained evaluation results (quantitative – numbers) form weights of particular model variables and as such become direct results of discussed research. Empirical effects of expert evaluations on both managerial levels (strategic and tactical) have been presented on Expert Choice (ver. 11.1.3805) screenshots below (Fig. 2 & 3).

Figure 2: Weights of model variables at strategic managerial level



Source: own elaboration based on top – management expert evaluations

Figure 3: Weights of model variables at tactical managerial level



Source: own elaboration based on middle – management expert evaluations

Relevance (weights) of particular indexes describing the development level of international companies (right screenshot window) under adapted criteria (left screenshot window), show that at strategic managerial level relying on operating profit, flexibility and survival ratio seem to be the most rational behavior when making decisions. At tactical managerial level same factors should attire decision – maker's attention, but their order differs: survival ratio, operating profit, flexibility. Due to lack of space and this paper's purpose, which most of all was the proposal of a general decision – making model in geopolitically turbulent environments, further analysis of expert evaluations presented above as well as their sensitivity graphs will be available in author's upcoming publications.

CONCLUDING REMARKS

The proposed decision – making model is the effect of five years of research. Due to space limitations only basic assumptions and reasoning that lead to model elaboration could have been presented. The path towards actual state of research can be followed in author's former publications. Nonetheless, it seems evident that a proper selection of a mix of indexes describing the development level of international companies assures a possibly optimal level of managerial activity under pre – assumed conditions of decision – making, here under determinants of geopolitical environment of the company in question.

The presented decision – making function can be subject to: optimization – i.e. optimization of decision – making effects, where the decision – maker tends to bring the weights of correct decisions in operating- and host - country environments (C_O, C_H) to highest possible levels (in other terms to make their share in general number of decisions taken in both environments (y_O, y_H) the biggest possible); minimization – when the manager aims at lowering wrong decisions' risk by trying to minimize weights of wrong decisions (W_O, W_H) in both environments or to lower their share in general number of decisions (y_O, y_H). Both possibilities can be achieved via mathematical procedures of optimization and minimization of geometrical functions and deserve separate publications.

Possible applications of the model fall far outside geopolitical decision – making. It can be applied to every decision problem, where decision – maker's criteria can be evaluated with a qualitative scale only. AHP evaluations allow their transposition into quantitative criteria that can be introduced and analyzed with proposed solution. It seems interesting and justified to continue the studies on decision – making anticipating geopolitical changes in the modern world. Especially promising seem the opportunities of further development of reasoning presented here and

its extension to fuzzy logic solutions, namely the Analytic Network Process, which allows taking into account also non – linear disturbances from geopolitical and other fields.

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