MCDM Methods in Practice: Determining Importance of PESTEL Analysis Criteria

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Abstract

Today, significant aspects of a business environment in which many companies operate represent turbulence and continuous globalization, one of the most significant competitive advantages is also the quality of decision making processes especially from the perspective of adequate integration of risk and uncertainty into these processes. A company which wants to survive and successfully develop is forced to deal with development trends which are influencing the company and its outside environment. Continuous changes in micro and macro perspectives create the necessity to constantly search for ways to ensure that the company succeeds at the market. This paper presents a comprehensive framework for the analysis and evaluation of various factors necessary in order to begin the company's expansion. This task is quite difficult and it is necessary to consider and efficiently analyze factors of macro environment by utilizing PESTEL analysis. Main aim of this paper is to execute an analysis of these factors and propose general decision making framework for companies from various sectors. Firstly, analysis of determined factors will be executed by DEMATEL method in order to find out possible causal relations among the criteria. Consequently, the weights and ranking of individual PESTEL criteria will be computed by AHP method.

Key words: PESTEL analysis, DEMATEL, AHP/ANP

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Introduction

Today, significant aspects of a business environment in which many companies operate represent turbulence and continuous globalization together with continuous repeating and transforming input conditions; one of the most significant competitive advantage is also the quality of decision making processes especially from the perspective of adequate integration of risk and uncertainty into these processes. The character of the 21st century and continuous

changes in micro and macro perspectives create the necessity to constantly search for ways to ensure that the company succeeds at the market. This paper presents a comprehensive framework for the analysis and evaluation of various factors necessary in order to begin the company's expansion e.g. into other regions. In a highly globalized world the companies have the chance to grow and develop; the companies are making effort to utilize potential for future perspective and efficiency of the company in new geographical areas. This task is quite difficult and it is necessary to consider and efficiently analyze factors of macro environment by utilizing PESTEL analysis. Macro perspective analysis enables the company's management to find especially the relations and connections among individual factors and also to realize and determine the opportunities and threats on which the company should concentrate on. Main aim of this paper is to execute an analysis of these factors and propose general decision making framework for companies from various sectors. Firstly, the analysis of determined factors will be executed by DEMATEL method in order to find out possible causal relations among the criteria. Consequently, the weights and ranking of individual PESTEL criteria will be computed by AHP method. Then the results from AHP and DEMATEL will be compared. The research will be executed in a company providing services.

Multiple attribute decision making methods (MADM) can be applied in many economic, financial and also personnel decision making tasks. When applying these methods the base is the decision-maker (subject), the purpose of decision making, overall decision making criteria (objective), variants, criteria (conditions) and criteria preference

1 Multiple criteria decision making methods

The multicriteria evaluation of variants method is a discipline, which is dealing with the research of decision problems, in which final number of variants is evaluated based on several criteria. In the multicriteria evaluation of variants models is given final group *m* variants, which are evaluated based on *n* criteria. Such decision situation can be described by criteria matrix, which follows, Fiala, Jablonský, Maňas (1994)

$$A_1 \quad A_2 \quad \dots \quad A_n \tag{1}$$

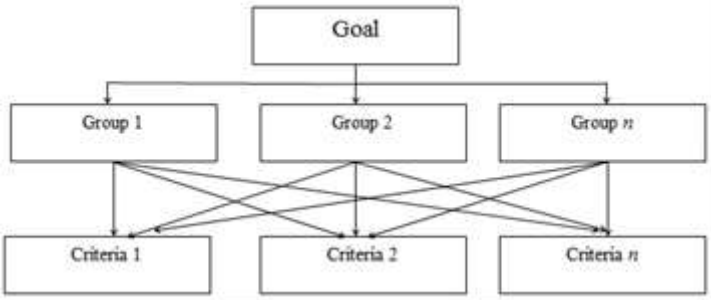
$$\begin{matrix} K_1 \\ K_2 \\ \vdots \\ K_m \end{matrix}\begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & \ldots & a_{mn} \end{bmatrix},$$

where individual rows correspond to evaluated variants (A_1, A_2, …, A_m) and individual columns to evaluated criteria (K_1, K_2, …, K_n) and for elements of this matrix applies that a_{ij} represents evaluation of i-th variant based on j-th criteria. The task is to find optimal variant or draw up ranking of variants based on their quality.

1.1 Multi-level decomposition methods AHP

Saaty's method for weight determination provides an objective mathematical procedure for determining preferences of individuals or groups in decision making (Saaty, 1980). Basic advantage of AHP method lies in the illustration of the problem which is represented in a hierarchical structure.

Fig. 1: General AHP structure



Source: Saaty, 1980

Many various methods exist for weight determination; the simplest ones are linear methods, in which are subjectively determined non-normalized weights of individual criteria in a priory agreed ranking scale. Second group includes so called non-linear methods, e.g. pairwise comparison, where Fuller triangle method or more complex Saaty method belongs. In this paper the aforementioned Saaty's method is used. The more the decision maker considers the criteria as more significant, the more is criteria weight higher. Preference is expressed in the interval $s_{ij} \in (1;9]$. The criteria weights can be determined very easily by so called approximation methods, which are practically well solvable by determination of normalized weights w_i by the utilization of geometrical mean of lines

$$v_i = \frac{R_i}{\sum_{i=1}^{m} R_i} = \frac{\left[\prod_{j=1}^{m} s_{ij}\right]^{1/m}}{\left[\sum_{i=1}^{m}\prod_{j=1}^{m} s_{ij}\right]^{1/m}}, i = 1, 2, ..., m. \quad (2)$$

More information pertaining to the computation can be found in (Dočkalíková, Kashi 2013).

1.2 DEMATEL

The DEMATEL method was originally developed by the Science and Human Affairs Program of the Battelle Memorial Institute of Geneva, between 1972 and 1976. It was designed to study and resolve complicated and intertwined problems (Tzeng, Chiang, & Li, 2007; Wu, 2008). This method is one of the structural modeling techniques that can identify the interdependences among the elements of a problem through a casual diagram by representing the basic concept of contextual relationships and the strengths of the influences among the factors; see Kashi, Franek (2014).

1.3 PESTEL analysis

The model examined in the present study is PESTEL (Political, Economic, Socio- cultural, Technological, Environment and Legal) analysis. PESTEL analysis has different definitions within the literature, such as PEST (Dare, 2006) and STEPE (Richardson, 2006). The original form of PESTEL was first conceived by Aguilar as ETPS (economic, technical, political, and social). This was subsequently reorganized as STEP for the Arnold Brown Institute of Life Insurance for use in strategic evaluation of trends. In was later modified to address macro analysis of the external environment or scanning for environmental change, and was defined as STEPE. In the 1980s, the legal dimension was added to this approach (Richardson, 2006). Apart from a technique for strategic analysis, PESTEL analysis began to be used in different fields (Katko, 2006; Richardson, 2006; Shilei & Yong, 2009).

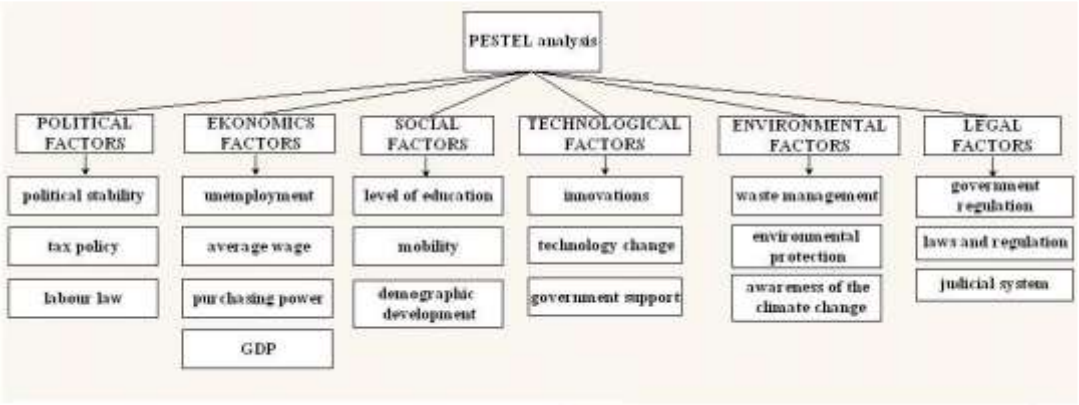
PESTEL analysis has two basic functions for a company. The first is that it allows identification of the environment within which the company operates. The second basic function is that it provides data and information that will enable the company to predict situations and circumstances that it might encounter in future.

2 Analyzing PESTEL factors by AHP and DEMATEL

Macro perspective analysis enables the company's management to find especially the relations and connections among individual factors and also to realize and determine the opportunities and threats on which the company should concentrate on. An example on which MCDM methods will be applied is simulating a situation in which the company X providing telecommunication services maps its macro environment and the result will be a general decision making framework and possible causal relations of criteria. The research question is if the ranking of criteria importance by AHP will give the same results as the DEMATEL method. The steps of the proposed PESTEL model are as follows:

Step 1: Identifying PESTEL factors and sub-factors and the form of hierarchic structure of PESTEL model. In this step, the relevant PESTEL factors and sub-factors were decided. However, because these factors do not enable detailed analysis of the macro environment of the company, the expert team identified detailed sub-factors that were relevant to the targets and aims of the company.

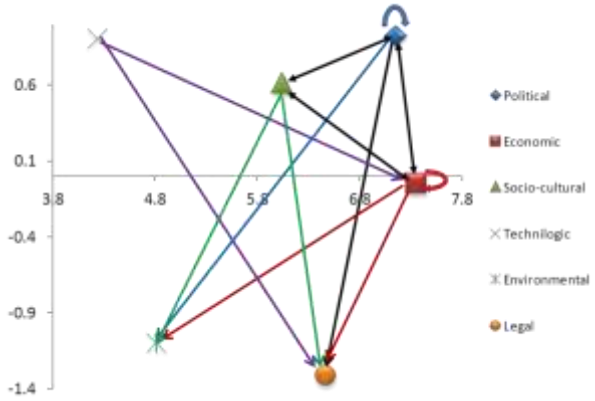
Fig. 2: PESTEL analysis



Source: Own elaboration

Step 2: Determining and mapping the potential inter-dependences between PESTEL factors by DEMATEL

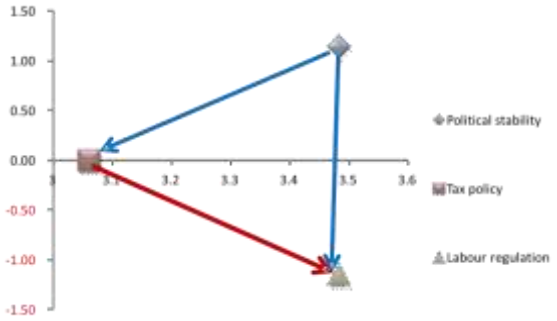
Fig. 3: Causal relations among the factors



Source: Own elaboration

From fig. 3 it is evident that the most important factor here is the technical and political one, since it influences the legal, the economic, the socio-cultural, and the environmental ones. Then the technological factor influences the economic and legal factors. The socio-cultural affects legal and environmental ones and economic affects environmental and legal ones. The environmental and legal factors are only affected by other factors but they do not affect any factors.

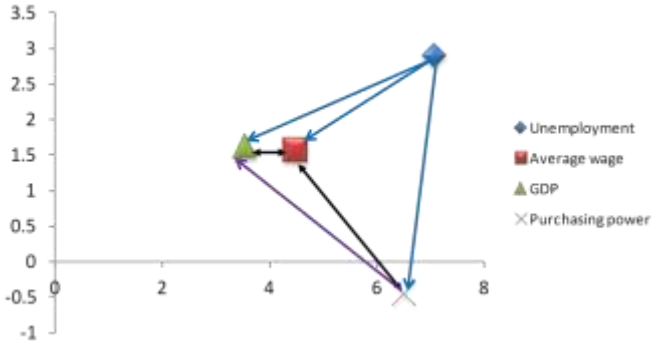
Fig. 4: Causal relations among the political factors



Source: Own elaboration

Fig. 4 shows that the political stability is the most important factor, since it affects both the tax policy and the labor regulation. The tax policy affects the labor regulation and labor regulation does not affect any of the factors.

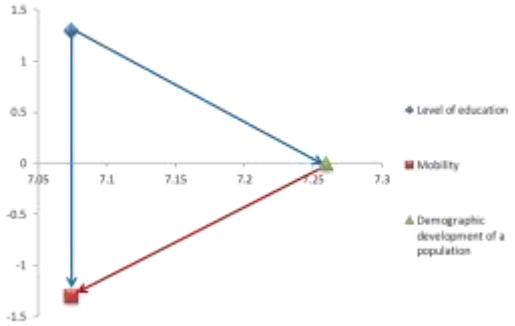
Fig. 5: Causal relations among the economic factors



Source: Own elaboration

Fig. 5 shows that the most important factor among the economic ones is the unemployment since it affects the average wage, the GDP and purchasing power. The average wage affects the purchasing power. The GDP only affects the average wage.

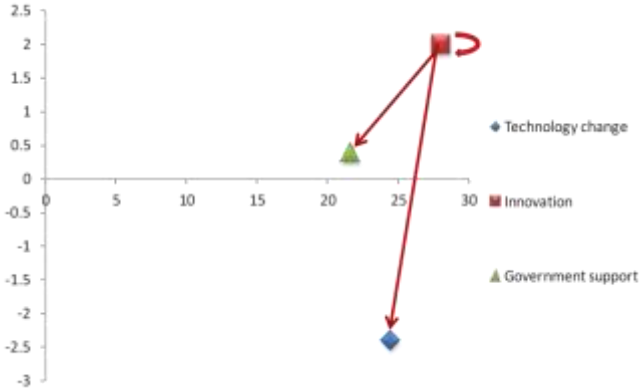
Fig. 6: Causal relations among the social factors



Source: Own elaboration

From fig. 6 it is evident that the level of education is the most important factor since it affects both the mobility and demographic development. Then demographic development of a population affects the mobility, which does not affect any other factor.

Fig. 7: Causal relations among the technological factors

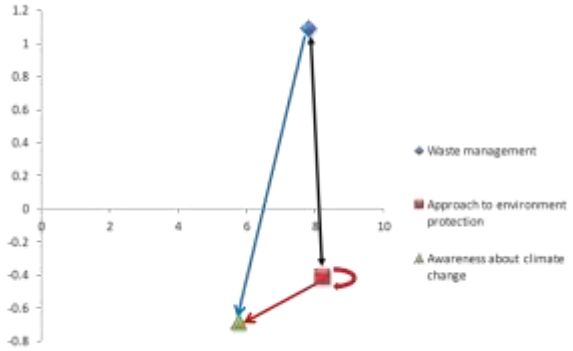


Source: Own elaboration

Fig. 7 shows that the innovation affects both the government support and the technology change.

Neither innovation nor the government support affects any of the other factors.

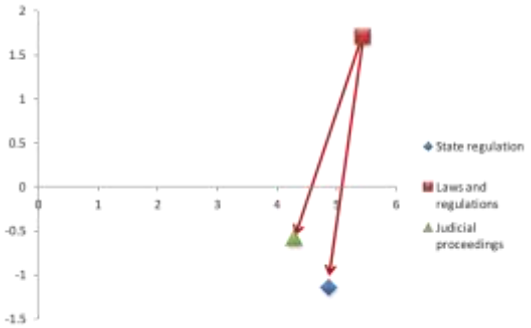
Fig. 8: Causal relations among the environmental factors



Source: Own elaboration

Here, in fig. 8 we can see that waste management affects the awareness of climate change and approach to environment protection. The approach to environment protection affects the awareness about climate change. Awareness about climate change does not affect any other factors.

Fig. 9: Causal relations among the legal factors



Source: Own elaboration

In fig. 9 we can see that the laws and regulations affect both the state regulation and judicial proceedings. Laws and regulations and judicial proceedings do not affect any other factor.

Step 3: Determining the local and global weights of independent PESTEL factors. In this step, the local weights of PESTEL factors were calculated. A pairwise comparison matrix was then formed by the expert team by using Saaty's method and according to hierarchy shown in fig. 2.

Tab. 1: Company providing service - local and global weights PESTEL factors

Criteria group	Weights of criteria's groups	Criteria	Local weights	Global weights
Political factors	0,0577	Political stability	0,3301	0,0191
		Tax policy	0,3914	0,0226

		Labor law	0,2784	0,0161
Economics factors	0,4471	Unemployment	0,2550	0,1140
		Average wage	0,1206	0,0539
		GDP	0,0850	0,0380
		Purchasing power	0,5393	0,2411
Social factors	0,1136	Level of education	0,1075	0,0122
		Mobility	0,6069	0,0689
		Demographic development	0,2856	0,0324
Technological factors	0,2272	Innovations	0,2583	0,0587
		Technology change	0,1047	0,0238
		Government support	0,6370	0,1447
Environmental factors	0,0408	Waste management	0,6046	0,0247
		Environmental protection	0,2906	0,0119
		Awareness of the climate change	0,1048	0,0043
Legal factors	0,1136	Government regulation	0,4742	0,0539
		Laws and regulations	0,3764	0,0428
		Judicial system	0,1494	0,0170

Source: Own elaboration

In the aforementioned table we can see the results of computation of expert's preferences. From tab. 1 it is evident that the economic factors have a much higher importance than other factors. Among the individual factors the purchasing power is the most important followed by government support and unemployment. This is due to the fact that purchasing power is the most important for the company providing telecommunication services.

Conclusion

Any company which wants to succeed and develop in a market economy must take into consideration development trends in their surroundings; the company must be flexible and must adapt to new trends.

In current, turbulent environment where the terms risk and uncertainty are a routine of everyday life, it is necessary to take them into consideration and not to omit them. Because the environment around the company is currently very unstable it is necessary to make and accept many risk decisions which can have an impact on the company's long term prosperity. In other case in the company is too careful it can cause the rejection of such strategic variants which are somewhat risky but can bring additional effects and enable the company to take the opportunities which is offered by the turbulent environment. According to the results of this

case study the AHP approach suggest that the company should concentrate most on economic factors and in individual factors on purchasing power, government support and unemployment. However the DEMATEL method came with different results, where the political factors affect most of the other factors. Individual factors which the most affect the other ones are the political stability, unemployment, level of education, technology change, waste management and state regulations. Therefore, if the company's interest is the economic factors the company should concentrate on the factors mentioned above before it decides to enter new markets.

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