Decisional Model of Relocating a Business in the Context of Current Economic Challenges Title of the Paper

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Abstract: Relocating a business where a company transfers part or all production facilities from one country to another, or from one city to another, it is a topical subject in the current economic context. Also known as "offshoring" or "relocation" relocation is a concrete and visible aspect of globalization of the world economy. Moving a business is a project that involves a great responsibility, because many issues to be resolved. Typically, the decision to move facilities into different locations or geographic areas is determined by a number of fundamental factors such as: production costs, the market, raw materials, infrastructure, labor, finance, tax issues, and so on. It is considered that relocation is not the response to a single risk factor (pollution, labor), although some research is so oriented, but an initial decisional complex, based on a number of social, economic, political and environmental factors.

According to research on the topic, a major influence on the relocation of a business has its extension and the need for increased profits. Another important reason for the decision to relocate is the cost reduction due to wage differences, economies of scale, energy prices and other economic and financial factors. Other authors believe that the position of central or local authorities is decisive by creating and maintaining a positive business climate through fiscal austerity, tax cuts and other "pro-business" policies such as labor law. Operational flexibility of a company, in terms of network size and restructuring strategies, is a significant factor for relocation of production. In addition to promoting innovation and a competitive regional advantage, businesses by providing jobs, generating revenues for local authorities and others, contribute to regional growth. As a long-term decision, supported by financial support significant aspects of physical, economic, social or political, behaving more or less predictable risks unidentified or incorrectly sized, making it difficult to substantiate and decision relocation.

This article aims in the first, identifying the criteria considered by various researchers, grouping and overlaps between them. The following is an attempt to develop an optimization model, considering the criteria selected in choosing a business location. Trying to determine the optimal location so as to be full in different proportions, the criteria identified above. To substantiate the decision to relocate production, the issue of choosing the optimal site will be approached as a multi-objective type. The ultimate goal of research is to develop a tool, easily applied by a company interested for making the decision to relocate.

Key-Words: Business, relocation, criteria, multiple-attribute, decisional model

1 Introduction

The relocation of the businesses is one of the subject of interest for the economic theory and practice and this is due to the spreading of this phenomenon, among the developed economies. This represents a decisional complex based on a series of social, economic, environmental and political factors and it can be described, as an action of moving into a new location, which involves a great responsibility, due to numerous aspects that have to be settled. It is well known the fact that, for a big size company, the most important aspects to be taken into consideration, when adopting a decision of relocation are: human resources, raw materials, utilities, reliability, legislation, natural environment, potential of innovation, the incentives granted by the local or central authorities, infrastructure and others [1],[2],[3]. The settlement of the issue involves the passing over the following steps:

- The configuration of some objective, determinant criteria, resulted from the study of other researches;
- The approaching of the issue of relocation, as a multiple-criteria decision;
- Solving the multi-attribute problem using various methods existing in the literature.

2 Research Organization

The research sought to substantiate the decision on site selection in case of relocation of production based on existing criteria in the literature. The decision involves finding a solution or a set of solutions that provide the best option for delocalization. The solution to the optimization problem answers the question: what is the optimal site location so that all the selected criteria are met in a different way? In order to answer the question, it is necessary to use decision models in the presence of a set of criteria called multi-criteria decision models, delimited as follows:

- Multiple-attribute decisional model. Such a model consists in choosing the optimal variant from a finite multitude of variants, compared between them, reported to other criteria. Each variant is characterized depending all the criteria belonging to a finite multitude.
- Multiple-objective decisional model. These are decisional situations in which the multitude of variants is finite. They generate models, which aims the maximization or the minimization of functions having more variables, subject to a system of restrictions [4]. It is followed the establishing of the values of the variables, which check the system of restrictions and optimize every function separately.

The multi-criteria optimization of the location decision was addressed in the form of a multi-attribute and multi-objective problem. For this paper the results obtained by considering in the form of a multi-attribute decision were synthesized. So, it is considered a lot of variant location V= {V1, V2,…,Vm} and a multitude of criteria taken into account C= {C1, C2,…,Cn}. For each criterion Cj, j=1,…,n, to each variant Vi, i=1,…,m, it is associated a vector representing, the result of the evaluation of that variant, depending on the criterion Cj. The choosing of the layout is one of the situations in which not all the criteria have the same importance. As a consequence, it is proceeded to the establishing of the importance of the criteria, using some coefficients xj,j= 1,…,n, which mentions the importance to each criterion separately [4],[5].

The literature of specialty offers different methods of settlement, of the multiple-attribute issue and in this category it is framed also, the optimization of the decision of choosing the layout (Table 1) [6],[7]. From the point of view of informational content, the methods can be:

a) Without information upon the preferences, if the decisional person hasn't information upon the fact that some criteria or variants are preferred in comparison with some others;

b) With information upon the criteria, which groups the problems according to the importance granted to each criteria, as follows [9]:

- In case of ordinal preferences, besides the matrix of the consequences, it is known also a vector V0={a01, a02,...,a0n} of the standard levels afferent to the n criteria. These methods eliminate the variants to which are afferent lower values, in comparison with the standard levels;
- Methods which settle the issue of relocation using the matrix of consequences and of some information upon the criteria, using the vector X=(x0, x1,...,xn) where (x0, x1,...,xn) is a permutation of the set of numbers {1,2,...,n}. The component xi mentions the place where is found the criterion Ci depending on the preference;
- Methods which allot certain cardinal preferences to the criteria. This means that the importance of the criteria, is given by the vector X = (x0, x1,...,xn), where $0 \leq x \leq 1$;
- Methods which bring the initial model to another form in which are taken into consideration only independent criteria [8].

From the multitude of the methods presented in Table 1, the issue of choosing the layout is framed into the group of methods, with information upon the criteria.

3 Solving the Problem

In order to solve the problem of relocation were considered the following criteria of comparison, equivalent to EU global domestic product (C1), inflation (C2), the rate of employment (C3), the unemployment rate (C4), infrastructure (C5), VAT (C6) and the minimum wage (C7) [10].

The goal is to maximize the C1, C3, C5 criteria, respectively minimize C2, C4, C6, and C7. The variants taken into account are represented by Eastern European countries, the geographical area of which is also Romania: Bulgaria (V1), Estonia (V2), Latvia (V3), Lithuania (V4), Poland (V5), Romania (V6) and Slovakia (V7). The decision matrix attached to the problem is presented in Table 2.The research sought to substantiate the decision on site selection in case of relocation of production based on existing criteria in the literature.For normalization of the matrix, account will be taken of the score in the range 0-7 for the infrastructure set by the authors and the average of the minimum wage of € 861 in the European Union [10].

Table 1 Methods for solving multi-attribute problems

Type of information	Complexity of information	Classes of methods
Without information		Method of dominance Maxi-min method Maxi-max method
With information upon the criteria	Standard level	Conjunctive method Disjunctive method
	Ordinal preferences	Lexical-graphic method Method of elimination based on aspects Permuting method
	Cardinal preferences	Linear attribution method Simple additive weighted method Hierarchical additive weighted method The method of diameters Onicescu method Electre method Topsis method Method of minimizing the deviation Saphier-Rusu method Scoring method
	Dependent criteria	The method of hierarchical combinations

Table 2 The decision matrix

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
V1	0.3	3.6	76.3	6.1	3.52	20	286.33
V2	0.2	4.5	83.9	5.1	4.68	20	540
V3	0.2	3.2	83.2	7.5	3.45	21	430
V4	0.3	2.8	83.1	6.3	4.7	21	555
V5	3.0	1.5	75.1	4.8	4.14	23	523.09
V6	1.2	4.2	72.7	4.8	2.96	19	446.02
V7	0.6	2.5	77.3	6.2	3.96	20	520

Among the presented methods, a method with standard criteria (conjunctive method), two methods with ordinate preferences on criteria (method of elimination with combinations of variants, elimination method through maximum value issue) and a method with cardinal preferences among criteria (simple additive weighting method).

3.1 Solving the relocation problem with the conjunctive method

The method assumes the selection of variants where, for all criteria, the property xij ≥ x0j for the maximum criteria and xij ≤ x0j for the minimum criteria, with j = 1,2, ..., 7 is fulfilled. If the matrix of consequences is comprised of the criteria of C2, C4, C6, and C7, and the mean V0 = {0.28, 1.59, 0.94, 1.45, 0.83, 1.12, 1.23} vector then the set of variants will be reduced to the V4 variant for Lithuania.

3.2 Solving the relocation problem with the elimination method with combinations of variants

It is considered V' a lot of variants characterized in a certain way by the criteria and either the value ε ∈(0,2). The probability that the Vi variant belongs to the V' is:

$$p(V_i,V')=\frac{\sum_{j\in J} u(C_j)}{\sum_{k=1}^{n} u(C_k)} \quad (1)$$

where$J_i=\left\{j|V_l\in V' \text{dacă} \left|x_{ij}-x_{lj}\right|\leq\varepsilon\right\}$.The optimal variation corresponds to a probability p(V_i, V') which records the highest value. It is consider the utility function u:{C_1, C_2, C_3, C_4, C_5, C_6, C_7}→N, u(C_i) = n-(i-1), with the property u= (7, 6, 5, 4, 3, 2, 1), ε = 0,20 and each combination compared to the variants V_i $|x_{1j}-x_{ij}|$ and the real utility of the criteria j will be compared to the variants V_i. By replacing the relationship, the values obtained are: V_1=0.583, V_2=0.548, V_3=0.613, V_4=0.607, V_5=0.375, V_6=0.429 and V_7=0.649. The maximum value is recorded for the variant 7 corresponding to Slovakia.

3.3Solving the relocation problem with the

elimination method through maximum value issue

If the normalized matrix R, the utility function is $u(C_i)= n-(i-1)$, u{ C_1, C_2, C_3, C_4, C_5, C_6, C_7}→N, $u(C_i) = n-(i-1)$,having property

R =

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
V_1	0.10	1.25	0.91	1.47	0.75	1.15	1.94
V_2	0.07	1.00	1.00	1.47	0.99	1.15	1.03
V_3	0.07	1.41	0.99	1.00	0.73	1.10	1.29
V_4	0.10	1.61	0.99	1.19	1.00	1.10	1.00
V_5	1.00	3.00	0.90	1.97	0.88	1.00	1.06
V_6	0.40	1.07	0.87	1.88	0.63	1.21	1.25
V_7	0.20	1.80	0.92	1.17	0.84	1.15	1.07

u=(7, 6, 5, 4, 3, 2, 1) and ε =0.20, and Vi=│x1j-xijmax│, then the real utility of the criteria will lead to the following values for the variants studied V1=0.286, V2=0.357, V3=0.250, V4=0.357, V5=0.893, V6=0.393 and V7=0.357. The number of variants is reduced to V5 and Poland respectively.

3.4 Solving the relocation problem with the simple additive weighing method

It is defined the function f:V → R, whose analytical expression is:

$$f(V_i)=\frac{\sum_{j=1}^{n} p_j \cdot r_{ij}}{\sum_{j=1}^{n} p_j} \quad (2)$$

The normalized R matrix and the vector are considered P=(0.14, 0.15, 0.14, 0.14, 0.15, 0.14, 0.14). If we calculate f(Vi) then the values obtained are: f(V1)=1.08, f(V2)=0.96, f(V3) =0.94, f(V4)=1.00, f(V5)=1.41, f(V6)=1.04, f(V7)=1.03. The maximum value is recorded for variant five corresponding Poland.

4 Conclusion

The article presents in the synthesis, the result of some research, with the purpose to substantiate the decision on the relocation of a business. The criteria used in the European Union were considered to solve the problem. The relocation variants correspond to the countries of Eastern Europe, the geographical area of which Romania is part. We have identified the existing methods in the literature on solving multi-attribute problems. The problem of relocation of a company is approached in the literature of specialty, in close connection with a determinant criterion.

Unlike this direction of research, the article presents, in a synthetic form, a decisional model which takes into consideration five objective criteria. The identified problem was treated as a multiple-attribute decision, having the advantage that it offers a solution using a small consumption of resources. The main difficulty with whom the presented models of multiple-criteria decisions are facing, consists in the fact that they can lead to different solutions, for one and the same problem.

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