MODELS FOR PRODUCTIVITY MEASUREMENT OF CENTRAL EUROPEAN COUNTRIES[1]

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Summary*: The paper presents the AHP model for productivity comparison of Central European countries accessing the European Union. The model consists of two basic parts. The first one estimates the importance of branches within the countries and the second one evaluates the performance of the firms within branches. Finally, the results of both the parts are synthesized and the productivity of the country is estimated. The evaluation is based on the data set resulting from a wide survey among industrial firms of selected important industry branches. The generalization of the AHP model in the form of a network structure expressed by the ANP model is draw out. The results and the future research are discussed in conclusions.*

1. Formulation of the problem

The main aim of the paper is to propose a methodological framework for evaluation of performance and identification of productivity gaps between selected Central European countries accessing the European Union and developed industrial western Europe economies. The paper describes and discusses issues and results of the international project focusing this subject of study.

The proposed approach starts with efficiency evaluation of selected firms of different industrial branches that are very important for all the countries included into the study. Then the results from the first step are aggregated and the efficiencies of the branches are derived. The last step consists in the aggregation of the results from the previous step according to the economic strength of the branches within the countries and finally the relative productivity measure for all the countries are derived. Due to the hierarchical nature of the mentioned process the problem can be expressed as an AHP or ANP model.

2. Performance evaluation models

Within the process of analysis of performance and productivity of countries it is necessary to take into account the performance of production units operating in these countries. As the production units can be taken important firms in different economic branches. Their productivity depends on many factors that can be divided into two basic groups - inputs and outputs. Inputs can be characterized as sources used by the firm during the process of producing outputs. Then, the measure of productivity of firms can be derived by a comparison of outputs and inputs. Usually holds that higher outputs and/or lower inputs lead

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to higher productivity measure. The knowledge of productivity measures of firms can be used for estimation of productivity measures of economic branches (according to the size of the firms including in the survey and other factors). Similarly, the importance of the branches within the selected country together with performance measures of branches can lead to estimation of productivity measure of the country. For evaluation of efficiency several techniques based on different principles can be used. The AHP method is not only a technique for evaluation of units but it can be with advantage used for hierarchical modeling of large and complex decision situations. Another framework that can be used for evaluation of performance of decision making units is Data Envelopment Analysis (DEA). The essential characteristic of the DEA model is the reduction of the multiple inputs and multiple outputs using weights computed by the model.

3. The AHP model

Because of hierarchical structure of the problem of evaluation of performance firms, branches and countries we propose a simple two step AHP model that contains the following basic levels:

1. Countries.
2. Branches.
3. Firms.
4. Criteria influencing the efficiency of firms (inputs and outputs).
5. Criteria influencing the position of the branches within the countries

The proposed AHP model contains the following three steps:

1. Estimation of the relative strength of the branches within countries.
2. Evaluation of performance of the firms within branches.
3. Synthesis of the results from the previous two steps.

4. The generalized ANP model

The generalized model for productivity measurement of Central European countries is based on Analytic Network Process (ANP) approach. In this model we take into account countries, branches, firms and criteria as clusters and different types of connections in the system. There are some dependencies and feedback among elements and clusters also. The whole system is more properly represented as network system. We state some examples of dependencies in the system. There are dependencies among countries given by foreign trade. The branches are interconnected and the flows can be modeled by input-output models. The questionnaire contains questions about networking activities of firms as rates of co-operation with customers and suppliers. The dependencies and feedback should be expressed by appropriate measures.

5. Conclusions

The analysis and design of production systems has been an active area of research. Performance models help to understand the behaviour of business systems and to provide guidelines to improve their performance. The proposed AHP model offers a simple approach for estimation of the performance scores of the countries. The possibility to use qualitative and hardly measurable characteristics is its advantage in comparison to other techniques. A large study taking into account a huge number of firms from much many branches is preparing and it will be the aim of our future research. Individual units are interconnected in a network system by material, financial and information flows. The network system is responsible for global performance whereas each unit is responsible for local performance. The ANP approach seems to be an appropriate method for performance measuring of network production systems. Future research will be oriented on more detailed and sophisticated network models and on methodology of performance measuring of network systems.