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EXPERT-MATHEMATICAL METHOD IN ANALYSIS OF ECONOMIC PHENOMENA

Summary. Expert methods belong to the group of heuristic methods, whose meaning plays more and more significant role in economic phenomena analysis. Data provided in such way should be characterized by good quality. The essential problem in expert research seems to be the problem of reliability of provided information, and what follows, its representativeness. In the article, the expert-mathematical method was presented as a method of determining the minimum size of the group of experts, which has a direct impact on research representativeness with assistance of experts. Presentation of the method is supported with empirical example.

Keywords: expert method, mathematical method, expert.

METODA EKSPERCKO-MATEMATYCZNA W PROCESIE BADAŃ EKSPERTÓW

Streszczenie. Metody ekspertowe należą do grupy metod heurystycznych, których znaczenie w obecnym czasie odgrywa coraz większą rolę w analizowaniu zjawisk ekonomicznych. Dostarczone w ten sposób dane powinny się charakteryzować odpowiednią jakością. Istotny w badaniach ekspertowych wydaje się problem wiarygodności dostarczonych informacji, a co się z tym wiąże – ich reprezentatywności. W artykule zaprezentowano metodę ekspercko-matematyczną jako metodę określania minimalnej liczebności grupy ekspertów. Prezentacja metody została poparta przykładami empirycznymi.

Słowa kluczowe: metoda ekspercka, metoda matematyczna, ekspert.

1. Introduction

Mark jet researches are based on systematic planning, garthering, analysis and transforming of data and pieces of information for people responsible for decision makeing in appropriate level of enterprises. Those researches are key point in providing pieces of information for traders. The most important aspect of the researches it to make it realiable and representative. Those conditions is based on appropriate sampling. The first step in that phase of research is to define general population and studied population. Than we have to declare samples, the sample size and method of choice of samples. The final stage of this phase is planning and choice of sample. After a careful attempt to determine the unit is selected a list of so-called study population. sampling frame, which is a set of elements of the population mapped on the list, which is then collected research sample. The sample is part of the general population selected using scientific methods. Participates in research and represents the general population with respect to the subject of research in such a way as to be able to generalize the results to the whole population. [1, 6, 10] For the calculation of the minimum sample is necessary to know the basic values of the general population, that is, for example. its size. Very often, however, it is not possible to determine the parameters of the general population from which to determine the required minimum sample size. In those situations the samples replaced by market experts' research, in which experts express their opinion on the subject of the study. The main source of information in the method of mathematical expert is expert knowledge on the subject of the study.

To audit to be credible and useful in decision-making, a team of experts must primarily be composed of experts whose views on the subject are considered moderately consistent. By compliance experts [9, 10] meant a uniform view of the experts on the topic. An important issue in the research of experts, however, seems to be the minimum number of experts, guaranteeing an adequate level of data reliability. Currently, the literature often encountered expert research, but they ignored the problem size of the group of experts.

Therefore, the primary objective of this article is to provide a method for determining the expert-mathematical in order to the minimum size of the group of experts. The article consists of two basic parts. In the first part of the paper presents the theoretical aspects of the method by expert-mathemtical. The second part of the work is an example of the application of the method described in the study in order to the effectiveness of integrated information systems. At this point it should be noted that this article is complementary to the work of the author on the topics on research experts [2, 3].

2. Role of expert-mathematical method in process of market analysis using experts

2.1. Basic issues

Expert methods, though little known, but the used in both foreign and Polish literature [4, 11, 13]. They are used in situations where other methods without success, or when other analytical methods cannot be used because of its limitations.

The main advantage of this method is that it allows to evaluate a variety of factors. The procedure of the method comprises the following steps [2, 9, 16]:

– organization of the study,
– selection of experts,
– testing,
– processing of test results.

The organization of the various steps of the method is flexible and allows for modifications. For example, obtaining expert opinion can be done on the basis of an individual interview, group or can be carried out using a questionnaire. Modifications may also be subject to processing the results of research in which the researcher himself individually chosen analytical methods in order to achieve the desired objective and research results. Most seems to be the step of selecting experts. In accordance with the requirements of experts must meet certain requirements. Above all, they must be a competent person with knowledge and experience in the area under investigation. In order to ensure the reliability of the method requires a minimum number of experts, guaranteeing the reliability of the test [7, 13, 16].

2.2. Minimal number of experts' problem

Introduction to any of the research is to determine the minimum size of the group of experts. The minimum size of the group of experts is evaluated based on the number of factors and is expressed by the formula [2, 6]:

$$n_{\min} = \frac{\chi^2_{\beta,k-1}}{(\gamma+1)(k-1)\omega_{kryt}} \tag{1}$$

where:

$\chi^2_{\beta,k-1}$ – value decomposition χ^2 or the assumed confidence level β and the number of degrees of freedom $k-1$,

k – number of factors assessed,

γ – established accuracy of concordance,

ω_{kryt} – the critical value of the coefficient of concordance by Kendall & Babington-Smith.

3. Samples of use of expert-mathematical method

Expert methods are nowadays more and more followers: [3, 4, 9, 11]. The use of mathematical methods for expert and presented in the article will be presented on two examples: in the process of research on the effectiveness of integrated information systems and research in the successful implementation of the success factors of IT systems.

Research on the effectiveness of integrated information systems was carried out among the creators of these systems. It was assumed that the developers of information systems will fall analysts, designers, programmers and developers of integrated information systems. In addition, it is assumed that an expert can be a person who works in a specific profession, not less than two years. The whole performance factors of integrated computer systems were divided into four groups relating to the enterprise environment (E_1), the production company (E_2), the creators of integrated systems (E_3) and information systems (E_4). Among the factors relating to the environment system included 11 factors. The group of factors related to the creators of integrated information systems comprised 30 factors. Factors characterizing the developers of information systems is a group of 12 factors. Integrated systems were characterized using 32 factors. In total, the study included 84 factors.

When calculating the minimum size of the group of experts was established accuracy concordance coefficient (Kendall & Babington-Smith) $\omega_{kryt} = 0,1$ and the accuracy of concordance $\gamma = 0,1$. Value of decomposition χ^2 for the assumed confidence level and the number of degrees of freedom $k-1$ is: $\chi^2_{0,95;83} = 105,26$. The minimum number of experts in the study was determined by the formula (1) and is $n_{\min} = 11,52$. Therefore assumed that the minimum size of the group of experts should be 12 people.

Research on implementation success factors of IT systems. The study was attended by about 120 people. Considered an expert person who dealt with the implementation of systems Reces 3 years. About 130 were selected success factors of system implementation. The minimum number of experts in the evaluation process required was calculated with the following assumptions: concordance coefficient accuracy by Kendall & Babington-Smith $\omega_{kryt} = 0,01$ and $\gamma = 0,05$. χ^2 for the assumed confidence level β and the number of degrees of freedom $k-1$ is: $\chi^2_{0,95;129} = 156,51$. The calculated minimum number of experts is: $n_{\min} = 24,02$. Therefore assumed that the minimum threshold for the size of the group should be 25 people.

Calculation of the minimum size of the group of experts is the first step in the process of research with experts. In a further study should be determined in a group of experts to ensure that they moderate consensus.

4. Conclusions

Expert methods meet the analytical method. Are used primarily in cases where it can not be empirically applied mathematics and statistical methods. Often also, that the results of a study of the phenomenon performed by analytical methods and demonstrate the superiority of mathematical expert and mathematical methods. The main advantage of the method is its flexibility expertise that allows the selection of a variety of statistical measures in the procedure. The first step in the study of expert should be to determine the minimum size of the group of experts. This study provides us with the size of the group, which ensures that researchers attempt will be sufficient when, of course, the relevant assumptions.

This paper presents a method of expert and mathematical. Particular emphasis is placed on the calculation of the minimum number of experts in the study group. The theoretical presentation of the methods supported by empirical example of calculation of the minimum number of studies on the effectiveness of integrated information systems and the success factors in the choice of implementation of integrated systems.

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Omówienie

Badanie rynku jest złożonym procesem, obejmującym między innymi etapy: planowania, gromadzenia danych i ich analizy. Aby były wiarygodne i reprezentatywne, ważne jest aby grupa, na której przeprowadzane są badania, odpowiednio odzwierciedlała populację. Bardzo często w badaniach nie jest możliwe określenie parametrów populacji, a co za tym idzie – nie można określić minimalnej liczebności próby. W takiej sytuacji badania rynku są zastępowane badaniami ekspertów. Eksperci w owych badaniach wypowiadają swoje opinie na dany temat. Jednakże również w badaniach ekspertowych ważna jest liczebność grupy. Kwestia ta jest jednak bardzo często pomijana. Przyjmuje się, że wiarygodność i rzetelność przeprowadzonych badań gwarantuje wyznaczenie współczynnika konkordancji.

Głównym celem pracy było zaprezentowanie metody, dzięki której możliwe jest wyliczenie minimalnej liczebności grupy ekspertów. Metoda w pracy została przybliżona przykładami empirycznymi. Minimalna liczebność grupy ekspertów została wyznaczona w badaniach nad skutecznością zintegrowanych systemów informatycznych.