

Model of Multi-criteria Ranking of Employees in Bookkeeping Agencies

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Abstract. *A significant part of entrepreneurial activity in Croatia is realized through small and medium-sized enterprises (SMEs), which for financial and other reasons contract their operative financial accounting to bookkeeping services. Topic of this article are bookkeeping agencies that do accounting for many business entities, and employ relatively large number of accounting experts so there are operative and organizational problems how to allocate clients to employees, and how to measure employee workload.*

This paper is aimed at developing a model of multi-criteria ranking and at selecting the most suitable employee in the bookkeeping agency to be assigned with new clients, by applying ELECTRE II, a method of multi-criteria decision making. In the development of the model, a group of employees in a bookkeeping agency was observed as a group of potential alternatives among which the optimal one should be selected. The model is based on defining the criteria for evaluation of the amount of workload among employees, and on investigating and determining the relative importance factors of the defined criteria as basis for application of the ELECTRE II method.

The purpose and the scientific relevance of the developed model is in creating a theoretical foundation for the determination and development of a professional system to be used as an online automatized support to decision making when distributing new business clients, or redistributing the existing business clients to different employees in a bookkeeping agency.

Keywords: bookkeeping agencies, business clients, bookkeeping services, multi-criteria

ranking of employees, method of multi-criteria decision making ELECTRE II, expert system

1 Introduction

Bookkeeping agencies are service companies involved in business activities that provide business subjects (clients) of all categories of small and medium size with bookkeeping and consulting services. The fundamental trait of their activities is a great diversity of business clients and their business data, and also the necessity of accurate and quality performance of bookkeeping services and processing of clients' business data in keeping with the law.

In a way, this paper is the continuation of authors' efforts to search for and find optimal solutions in the field of information systems in the bookkeeping agencies [1, 2].

In the Republic of Croatia the majority of business subjects are small and medium sized enterprises. By business subjects we mean all legal and physical entities engaged in business activities aimed at making profit on the market. Consequently, included are all legal entities registered in the register of companies, but also physical entities that run small businesses, in legal form of craft that are registered in the Central Crafts Register Department. Unfortunately, there is no integrated classification of these subjects; the Central Bureau of Statistics has information from the register of business subjects that in the Republic of Croatia there are 105.690 active legal entities (situation on 31.03.2009). Here we must add 96.332 small businesses (crafts) in operation, since craft is one of the possible forms of legal organization of a business venture (data obtained from the Central Crafts Register Department).

Given that the majority of legal entities are subjects engaged in the small economy¹ – over 99% [6, 7, 8], according to Kersan-Škrabić and Banković [7] the small economy in the Republic of Croatia has assumed almost equal importance as it has in the EU, if we compare the shares of small and medium sized enterprises (SMEs) in the total number of enterprises and the employment rate. In the 2000-2005 period the share of SMEs in the number of employees and the overall income and profit, has slightly dropped, probably as a result of the stronger pressure of competitiveness and the globalization process. Specifically, in the conditions of globalization, SMEs are primarily present on the local markets, in other words they are filling in the gaps that are left behind after the large economic subjects and, at the same time, they meet the needs of those large enterprises. One of the most significant obstacles for the development of SMEs in both the EU and the Republic of Croatia is shortage of skilled work force. Since the focus is always on their key activities, the small and medium sized enterprises find it inefficient to spend their resources on employing persons solely for bookkeeping, which is where bookkeeping agencies come in as experts in dealing with the abovementioned duties.

In the course of research the authors of this paper tried to obtain information on the exact number of bookkeeping (bookkeeping and accounting) agencies in the Republic of Croatia, but it turned out that no such records exist. The total number of legal entities classified under predominant business activities in accordance with the NKD 2007 /National Classification of Activities: 69.20 Accounting, bookkeeping and auditing activities; tax-related consultancy, according to the Central Bureau of Statistics in April 2009, amounted to 5.101². But, this figure also includes subjects whose primary business activity is auditing or consultancy. For that reason, the search of the publicly accessible database of the Croatian Chamber of Commerce - Biznet [9] was

¹ According to the Stimulation of Development of Small Economy Act (*Official Gazette* NN 630/02, NN 63/07), small and medium sized enterprises are considered as the small economy, but also to legal and physical entities engaged in profit-making activities, which is different to a certain extent when related to small, medium and big sized enterprises in the sense of the Law on Bookkeeping (NN 109/07), which includes legal entities and physical entities that are liable to pay profit tax, but excludes physical entities that are liable to pay tax on the income from private businesses.

² It needs to be pointed out here that at registration the business activity of companies and crafts that is listed on top is often considered as their main business activity rather than the one on which a company/craft will earn the largest part of its income; as a result, in this set of activities business subjects that are not really engaged primarily in providing services of bookkeeping, accounting, auditing and business consultancy will sometimes find themselves in that group. Based on reviewed sample of some hundred enterprises at the Biznet data base of the Croatian Chamber of Commerce, we estimate that some 10% of business subjects are classified here. Biznet is a base that contains legal entities, but not crafts.

conducted by using the key words ‘accounting’ and ‘bookkeeping’. The results of the search showed that there are 1.247 active trading companies whose full name includes ‘bookkeeping’ (and its variants), and 927 subjects whose name contains the word ‘accounting’ and its variants. Since some of the subjects have both key words in their names, having analyzed a sample of some hundred such subjects, we came to estimation that this is the case in about 20% of subjects that have the word ‘accounting’ in their names, which led us to an approximate figure of 1.925 legal entities that provide bookkeeping services. A similar search and processing of thus gathered data from the Central Crafts Register Department [10] gave us the figure of at least 700 crafts that offer bookkeeping services. According to the obtained data, the total number of business subjects that provide bookkeeping/ accounting services amounts to around 2.600. It was impossible to obtain information through any search of accessible databases about the number of small and medium sized enterprises that do not have their own bookkeeper; however, we can definitely say that they constitute the largest part of all registered business subjects.

2 Reasons for evaluation of performance of employees in bookkeeping agencies and related problems

Bookkeeping agencies as business subjects are predominantly small sized enterprises, or crafts registered to bookkeeping, or accounting services. Given their internal organization, the division of work usually implies that each employee processes certain number of business clients, but it is also possible that several employees are in charge of a single client. In terms of organization a problem arises when a new clients shows up: who will he or she be assigned to? Similar problem also arises when a business client leaves the bookkeeping agency, because in that case it is necessary to redistribute the workload among all employees. We assumed, and our subsequent research later confirmed our assumption, that the level of education is approximately the same with all employees, i.e. that employees have predominantly the secondary-school education, with a small number of highly educated in larger agencies, but since that was not a criterion that could affect the redistribution of workload, from that point of view there is no difference between them.

In terms of work volume, the goal of every bookkeeping agency and its owner(s) is to process as many business clients as possible with as few employees as possible. Business clients come from different economic sectors and with different amount of business documents that a bookkeeping agency is supposed to process. Given the nature of business

relationship, which most often calls for direct communication between the employee and the business client, the quality of that communication often arises as a problem. As a rule, each employee processes a number of business clients with different volume and complexity of work. Usually, there are no problems with the distribution of workload, except when there is a change in either the number of business clients, or of employees (hiring, firing, redistribution of work, sick leaves, etc.). Here we have the problem of fluctuation of the number of business clients (some new come in, some old leave the agency). The result of distribution of business clients among the employees directly affects their performance and their content, or discontent, depending on how balanced was the distribution of among all employees. The problem of discontent and dealing with that problem also depends on the organizational culture of the bookkeeping agency in question, and on the interpersonal relations in the given agency.

In view of the above, this paper is intended to look into a concrete set of criteria and their relative significance, with an aim to develop in a consistent manner a model for multi-criteria ranking of employees; on one side that model is based on the determination of criteria of importance of evaluating the performance of employees both in terms of quantity and quality, and – on the other side, it is based on examining and determining the factors of relative importance of the determined criteria as foundation for the application of selected method of multi-criteria of ranking and decision making.

3 Research of criteria for multi-criteria ranking of employees in bookkeeping agencies

Prior to looking into the problem of employees' ranking and distribution of workload, a set of questions and a set of potential criteria for the multi-criteria ranking of employees were defined. Questions were used as auxiliary means of conducting interviews in bookkeeping agencies. The questions relating to the evaluation of importance of criteria were posed by using the Lickert scale with offered values on a 1-10 scale. Ten is the criterion of greatest importance, but it is possible that several criteria are evaluated as equally important. Once the questioner recorded all data on the importance of each criterion that he had received from the respondents, most of them the heads of bookkeeping agencies, they were asked to additionally rank all criteria, from the most important to the least important. This removes every doubt in the judgment of respondents as regards the importance of criteria.

The research in the form of interviews was conducted through personal contacts in five

bookkeeping agencies in the areas of Varaždin and Zagreb. The size of these agencies is expressed in the number of employees ranging between 2 and 20, while the number of their clients ranges from 30 to 270.

The completed research confirmed our assumptions about the objective presence of the problem and evaluation was obtained of the importance of the criteria for employees' ranking. The data obtained in an average bookkeeping agency are given in Table 1.

Table 1. Tabular survey of data relative to an average bookkeeping agency

Nr	Item	Value	
1	Total number of employees in agency	8	
2	Total number of clients	95	
3	Structure of business clients - crafts	36	38%
4	Structure of clients – (type of company)	59	62%
5	Average number of clients per employee	14	
6	Type of communication channel	Personal contact	
7	Fluctuation of clients (on a yearly basis)	Low	
8	Arrival of new clients, yearly	4	4.2%
9	Leaving of existing clients (yearly)	3	3.2%

Based on the data given in Table 1, it can be concluded that bookkeeping agencies are in most cases small organizations staffed with an average of 8 employees, who process in average about 95 active business subjects in the Republic of Croatia. In most cases these are companies with limited liability and crafts, but also non-profit associations and similar subjects, but – given their scarcity, they were disregarded. A single employee processes 14 clients in average. The fluctuation of the number of clients was estimated as relatively low in all bookkeeping agencies, but expressed in percentage, and in view of the fact we talk about long-term business relations, it amounts to 4% a year. This leads us to a conclusion that the problem of distribution of new and redistribution of the existing business clients arises at least seven times a year in average, and that is relatively high incidence, given the nature of this particular type of business activity.

In addition to other reasons for the redistribution of workload and the subsequent problem of employees' ranking, the change in number of business clients as described above has been recognized as a grave problem that is worth addressing, and especially so in the bookkeeping agencies with more than four employees. It was confirmed that business clients

most often communicate with their bookkeeping agencies personally or over the phone, and a little less often via e-mail. It was established that in 50% of bookkeeping agencies the level of qualification has no influence on the number of clients that they process, and that in the education-related structure predominant is the secondary-school education with

several experts with a university degree usually present in large bookkeeping centres. Along with these result and initial assumptions, and on the basis of the rectified assumed criteria for multi-criteria ranking, Table 2 shows criteria on the basis of which it is possible to evaluate the volume and complexity of the workload of each employee.

Table 2. Criteria for multi-criteria ranking of employees in bookkeeping agencies according to the data on assigned business clients

No.	Description of criterion	Criterion mark (K)	Measure	Criterion type	Average rating of importance (X _i)
1	Clients processed by employee	K1	Number	Maximum	6,50
2	Clients' employees	K2	Number	Maximum	6,50
3	Clients' buyers	K3	Number	Maximum	2,33
4	Clients' suppliers	K4	Number	Maximum	2,33
5	Salaries paid by clients /year	K5	Number	Maximum	5,67
6	Clients' commodity-related documents /year	K6	Number	Maximum	8,75
7	Clients' UFA (incoming invoices) and IFA (outgoing invoices) /year	K7	Number	Maximum	9,00
8	Clients' bank statements /year	K8	Number	Maximum	9,00
9	Clients' VAT returns / year	K9	Number	Maximum	6,75
10	Clients' statistical reports /year	K10	Number	Maximum	1,75

Based on all criteria taken into consideration, and initially there were 17 of them, we – together with the respondents, filtered out a total of 10 criteria, and they were used to evaluate the importance on the 1-10 scale. Ten on the scale denoted the most significant importance, one the least significant importance. The

graphic layout below (Fig. 1) shows average ratings of the importance of individual criteria. The rank order of criteria was arranged in accordance with the average rating of importance of each criterion. The highest level of importance is given at the lower part of the graphic layout.

Criteria for multi-criteria ranking and their importance

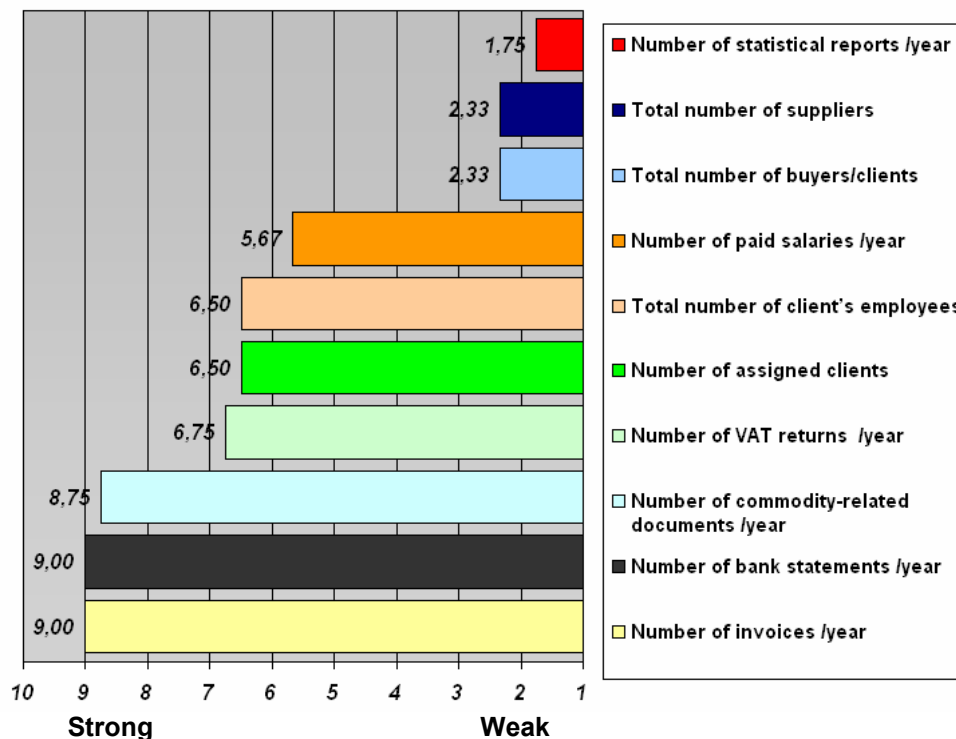


Figure 1. Average evaluation of importance of each criterion

As can be seen from Table 2, the values of all criteria are of quantitative nature, and they pertain to aggregate data on business activities of the clients of a bookkeeping agency.

The same measure (Number), type (Maximum), and the same order of magnitude (1 – N) of all criteria indicate that, in accordance with ELECTRE II method, the initial decision-making pattern (Table 3) does not need to be normalized.

From the point of view of workload, a bookkeeping agency employee is most encumbered if by all criteria relative to business clients assigned to him, he has maximum values, and vice versa.

Variable v_{ij} in Table 3 represents the real aggregate value of criterion 'j=1,...,N=10' for a bookkeeping agency employee 'i=1,...,M' which can be obtained from the business database of the bookkeeping agency.

Table 3. Initial decision-making pattern for the ranking of employees of a bookkeeping agency

K/Z	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀
Z ₁	V _{1,1}	V _{1,2}	V _{1,3}	V _{1,4}	V _{1,5}	V _{1,6}	V _{1,7}	V _{1,8}	V _{1,9}	V _{1,10}
Z ₂	V _{2,1}	V _{2,2}	V _{2,3}	V _{2,4}	V _{2,5}	V _{2,6}	V _{2,7}	V _{2,8}	V _{2,9}	V _{2,10}
Z ₃	V _{3,1}	V _{3,2}	V _{3,3}	V _{3,4}	V _{3,5}	V _{3,6}	V _{3,7}	V _{3,8}	V _{3,9}	V _{3,10}
...
Z _M	V _{M,1}	V _{M,2}	V _{M,3}	V _{M,4}	V _{M,5}	V _{M,6}	V _{M,7}	V _{M,8}	V _{M,9}	V _{M,10}
W	0,11096	0,11096	0,03977	0,03977	0,09679	0,14937	0,15364	0,15364	0,11523	0,02987

Variable W_j in Table 3 represents the relative importance coefficient (weight) of the j^{th} criterion, calculated by the following formula:

$$W_j = X_j / \sum X_j, \text{ where } X_j \text{ is average rating of importance of the } j^{th} \text{ criterion from Table 2, with } \sum W_j = 1.$$

4 Multi-criteria ranking of employees in a bookkeeping agency by using ELECTRE II method

In the above chapter we investigated and analyzed the set of possible criteria for the multi-criteria ranking of employees in a bookkeeping agency, and defined the basis for application of one of the methods of multi-criteria decision-making.

There are several known methods of the multi-criteria decision-making (AHP, PROMETHEE, TOPSIS, ELECTREE, and others). Their mathematical background and mutual comparison are not the subject of this paper. They are based on the classification of the elements in a set (alternatives) into subsets by applying several objective factors (criteria) at the same time, which are associated with each element of the set.

In mathematical terms, those methods are complex, but there are some developed and quality IT solutions that automatize and simplify the complex mathematical procedure such as application SANNA 2007 [11].

There were two reasons why the authors of this paper chose ELECTRE II [3, 4, and 5] as a suitable method of finding solution to the problem of multi-criteria ranking of employees in a bookkeeping agency. The first reason lies in the frequent application of this method in finding solution to concrete problems of multi-criteria decision-making, the second in the specific option of this particular

method that corresponds with the nature of the problem in question.

Specifically, this option entails introduction of the so-called concordance index and discordance index, which represent quantitative measures of concordance or discordance in the outranking of alternatives in terms of simultaneous employment of all criteria. In keeping with the above, the decision maker is able to determine the level of concordance S_u (how much concordance he requires) and the level of discordance N_s (how much discordance he can tolerate). By choosing the highest levels of concordance ($S_u=1$) and the lowest level of discordance ($N_s=0$) it is possible to single out only the alternatives that are «better» by all criteria simultaneously.

Below is a simplified display of the algorithm of method ELECTRE II, adjusted to the model of multi-criteria ranking of employees in bookkeeping agencies.

Let us have a defined set of N_1 alternatives (employees) a_k , where $k=1,2,...,N_1$.

Each employee a_k is described by the defined set of M quantitative criteria $f^1_k, f^2_k, \dots, f^M_k$, where $i=1,2,...,M$. Coefficient of relative importance R_n , is associated to each criterion, where $n=1,2,...,N_2$.

Oriented graph $G_n = (A, L_n)$ is constructed for each i^{th} criterion, where the set of nodes A is transparent in relation to the set of alternatives (employees), and L_n is a set of arcs, to which the following relation applies: $(a_k, a_j) \in L_n \iff f^i_k \geq f^i_j$, where $n=1,2,...,N$.

Symbol \iff denotes equivalency, and symbol \geq denotes the relation of preference “at least as good

as". In the described way N is obtained of fully transitive graphs G_j , where $j=1,2,\dots,N$, and each of them determines the rank of alternatives (employees), but only on the basis of the respective criterion.

In graph G_j there is an oriented arc only in the case if, according to a certain criterion the alternative a_k is 'at least good as' as alternative a_j .

In the following steps a synthesis is made of all graphs G_j into graph $G_o = (A, L_o)$, where $L_o = L_1 \cap L_2 \cap \dots \cap L_n$, so that the following relation applies:

$$\forall (a_k, a_j) \in L_n \Rightarrow (a_k, a_j) \in L_o.$$

Graph G_o provides the rank of employees in the A set, based on all criteria simultaneously. In case that graph G_o does not provide a full rank of all alternatives (employees), then it should be supplemented by new arcs on the basis of the concordance index $I_{su} = (0,1)$ and discordance index $I_{ns} = (0,1)$.

The concordance index represents the level of concordance, whereas the discordance index represents the level of discordance with the statement that the alternative (employee) a_k is 'better, or at least as good as' a_j .

The process of supplementing graph G_o is completed when, upon selection of suitable values of indices I_{su} and I_{ns} as thresholds of concordance and discordance, a solution is reached in the form of graph G that contains arcs between all pairs of alternatives (employees).

The pattern applied in the bookkeeping agencies is a solution that provides optimal ranking of all employees, which enables the policy maker to make an objective decision when assigning a new client to

the most suitable employee, redistribution of the existing business clients among employees, or when awarding employees for their performance.

5 Possibilities of applying the model of multi-criteria ranking of employees in the information systems of bookkeeping agencies

Based on the research conducted for the needs of this study, we have determined the initial set of 10 quantitative criteria that affect employees' workload, which can be quantified in real-time on the basis of the data contained in the business database of the information system in a bookkeeping agency.

Of course, that set is not final, it can be modified as required by the business strategy mapped out by the bookkeeping agency.

The research also revealed initial values of the relative importance of each criterion, which may also be modified as required for the same reason as above.

If the workload of employees in a bookkeeping agency varies throughout a business year, then the workload of each employee should be continuously monitored and compared with that of other employees; also, the ranking of employees should be continuous in terms of his or her current workload in order to be able to fairly award them and to make appropriate business decisions should it be necessary to distribute new business clients among the employees, or redistribute the existing ones.

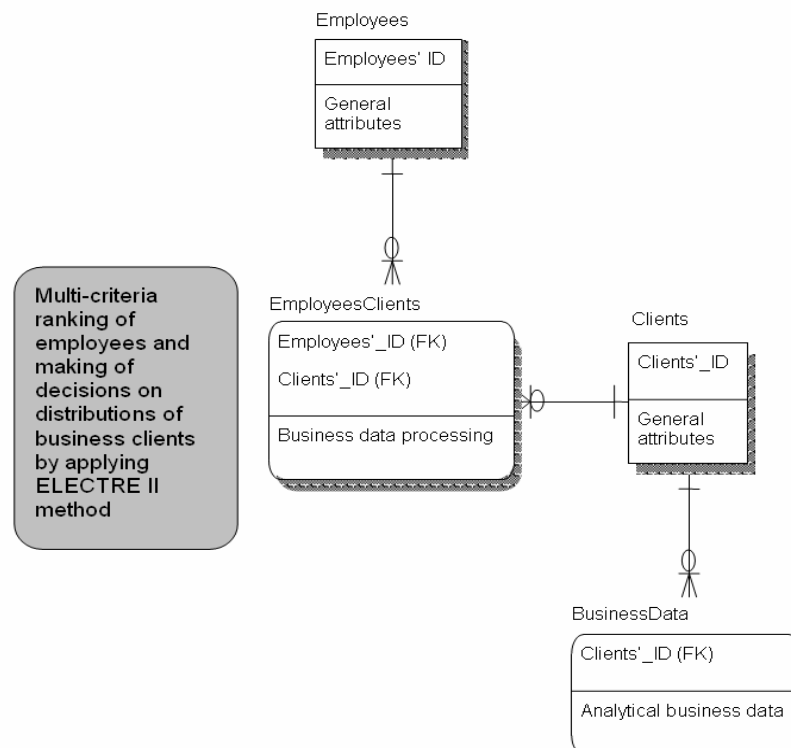


Figure 2. Conceptual model of a professional system of multi-criteria decision making in a bookkeeping agency

In view of the above, this paper suggests introduction of a new model within the scope of the system of business applications in bookkeeping agencies that will have the role of a professional system designed for the multi-criteria decision making (Fig. 2) including the following functions at a minimum:

- management of the system of criteria for multi-criteria ranking of employees;
- management of the system of the factors of the relative importance of criteria;
- multi-criteria ranking of employees in real time, based on current data on workload, for the purpose of business decision making.

When considering the fundamental business strategy of a modern bookkeeping agency as an enterprise that makes continuous efforts to optimize its business activities by processing as many business clients as possible with as few equally burdened and equally educated employees as possible, then the implementation of the mentioned strategy without the described professional system is not possible.

6 Conclusion

The experience of authors of this paper in the development of information systems in modern bookkeeping agencies points at the fact that business activities of the business subjects of this particular type are characterized by some significant specific traits, and that the overall efficacy of such organizations depend on the objective and optimal decision making in the process of distribution of business clients among employees.

Already in several randomly selected and very different bookkeeping agencies presented in this paper the research results have confirmed the hypothesis that such organizations are facing a complex problem of human resources management, and that – due to a large number of influential factors, it is hard to make objective decisions and ensure a balanced workload for each employee by applying classical methods that are based on prior experience. Among other reasons, this was the main reason why the research did not encompass far more bookkeeping agencies in the Republic of Croatia.

Given that general methods of multi-criteria decision making offer great opportunities and are applicable as system methods of resolving complex problems in different fields, the authors of this paper deem the ELECTRE II method suitable as well for resolving the problem of multi-criteria ranking of employees of large bookkeeping agencies.

In view of the above, the general model of multi-criteria ranking of employees following the ELECTRE II method and the conceptual model of a professional system as part of an information system,

can serve as a foundation for continuance of research of this problem at two levels.

The first level is the level of organizational culture within a bookkeeping agency, and decision making regarding the distribution of roles and assignments to employees on the basis of objectively evaluated workload.

The second level is the level of information system and business applications within a bookkeeping agency, which should be the basis of an automatized professional system for management and control of the en masse processing of data relative to the business activities of business clients and dynamic multi-criteria decision making in terms of a balanced distribution of workload among employees.

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