African Journal of Business Management Vol. 6 (9), pp. 3221-3233, 7 March, 2012
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM11.1500
ISSN 1993-8233 ©2012 Academic Journals

Full Length Research Paper

Application of fuzzy logic into process of decision making regarding selection of managers

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Accepted 27 September, 2011

This paper exemplifies the possibility of applying fuzzy logic into the process of decision making regarding the selection of executive managers. The decision making process related to the selection of executive managers has been conceived in such a way that human resource (HR) departments assess candidates with application of a grade system. Candidates can be assessed against defined mangers' goals. Research concerning managers' general goals was used for this paper and the goals which research has proved to be of the greatest relative weight were selected. The application of fuzzy logic, along with a multi-criteria analysis, is very convenient for decision making (selection of candidates, optimization of processes, choice of the optimal variant, etc) when there is vagueness, uncertainty and a great number of candidates. This paper discusses the process of making an optimal - preferential decision (choice of an optimal manager for leading positions in a company) by application of fuzzy logic and a fuzzy system.

Key words: Manager, fuzzy logic, fuzzy systems, manager's goals, optimization, selection.

INTRODUCTION

Selection of an optimal manager for a leading position in a company is a very important strategic decision for a human resource (HR) department in a company. The role of the HR department is to screen a number of received applications and select an optimal candidate among those who are applying for the position of an executive manager. Recruitment and selection of the optimal candidate can be carried out in many ways, such as, through individual assessment of candidates, testing of candidates, requesting formal qualifications, specific work experience or achieved results, application of a multi-criteria analysis, etc. The selection of an optimal candidate can also be conducted by taking into consideration a number of candidates from the perspective of their personal goals goals in the role of a manager. Those responsible for making decisions regarding an optimal candidate for a manager's position in a company are rarely faced with a situation that only one candidate has responded to the job advertisement. Almost always, a great number of candidates apply for the job so that the candidates should be ranked and a conclusion drawn as to which of them may be an optimal choice for the company (Coleman, 1997).

Currently, there is growing concern among senior organizational management over just how to seek out greater efficiencies in performance through the training, skills development, and implementation of best practices with the ability to make working teams more competitive. Only firms deploying teams with these abilities and skills well developed remain competitive (Sirmon et al., 2011). According to Guthridge et al. (2006), firms get better results if they involve senior management in developing employee skills right from the earliest formulation of strategies. Those who believe they can develop skills misaligned with strategies lose the opportunity to align the behaviors and capabilities of human capital with the business priorities defined Business leaders must find ways to act so that middle managers take responsibility for developing the skills of the employees they supervise. They should consider staff development as an explicit annual goal. According to Porter (1985), leaders who

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believe in dynamic change as the predominant factor are capable of creating competitive advantage favorable to their business and, consequently, to their partners and the countries where the companies are located.

Moreover, many firms encourage the notion that the greatest source of competitive advantage lies in the human resources (HR) they detain. The role of HR managers should be to pinpoint the strategy able to achieve the organization's goals. The models and techniques deployed are highly significant to all managers in dealing with their employees under all the circumstances that organizations may encounter. HR development is an extremely relevant factor in improving productivity and bringing about organizational effectiveness and efficiency (Burke 2006). Management development is a process of training and growth in which management staff grasp, understand, and deploy the personal managerial supply skills, knowledge, attitudes, and insights to manage their organizational roles efficiently so that its goals are achieved.

Many firms still consider that the management of HR capabilities is a short-term issue, while the strategic management of the business represents a long-term goal. Grounded in the resource-based view (RBV) of the firm, the theory suggesting that resources influence firm performance is largely supported empirically (Barney, 1991; Ghemawat, 1991; Grant, 1991; Sirmon et al., 2011). Nevertheless, those authors show that this influence is the result not only of possessing the resources but also of how managerial action engages with structuring the firm's portfolio of resources and bundling them into capabilities able to realize competitive advantage. Guthridge et al. (2008) consider that, in order to manage HR capabilities, the heads of firms should recognize that strategies cannot only focus on the capabilities of business leaders as reality is made up of different people with different genders, ages, and nationalities. Thus, successful HR management needs to place the entire workforce at the heart of the business strategy, and this requires not only the acquisition of further and improved skills by all involved, but also continuous monitoring, motivation, and support by management in general, and HR managers, in particular.

The debate about the strategic value of HR and analysis of its impact on business competitiveness has aroused great interest among researchers and theorists in the field (Saa´-Pe´rez and Garcı´a-Falco´n, 2002; De´niz-De´niz and Saa´-Pe´rez, 2003; Lengnick-Hall et al., 2009; Newenham-Kahindi, 2011). The reasons are many and varied, although increased global competition and the search for sources of sustainable competitive advantage are certainly two of the strongest drivers. According to Dyer and Reeves (1995), this attempt to identify the foundations for sustained competitiveness given the competitive challenges posed by globalization, first the price level and, both then and now, the quality of customization, service, and the speed of innovation have been variables around which competitive advantage has been based. However, when factors such as capital and technology became available to virtually everyone and everywhere, the search for sources of sustained competitive advantage is increasingly oriented toward organizational capabilities (Ulrich and Lake, 1990), and more specifically toward the strategic value of HR (Cappelli and Singh, 1992; Wright and McMahan, 1992; Newenham-Kahindi, 2011). As noted by Pfeffer (1994), people and how they are run acquire ever-greater importance because many other sources of competitive success are less powerful than they once were. This recognition that the very basis of competitive advantage has changed is essential to developing a framework for dealing with different aspects of management and strategy.

Hence, HR requires additional capabilities as well as support for developing their role and placing them at the heart of the business strategy. This study focuses in particular on analysis of the determinants of competitiveness of a specific company type (agency) in a particular sector (retail banking). Since the 1980s, the banking environment has experienced various changes to its competitive market environment worldwide and with direct consequences for both the nature and the level of competitiveness (Canhoto, 2004; Cabrita and Bontis, 2008). Historically, several factors have been referred to and including market deregulation, the development of capital markets, and the reduction in demand for corporate loans, technological innovation, and the competition deriving from various financial systems (Ennew et al., 1990; Trethowan and Scullion, 1997; Canhoto, 2004; Chi, 2010; Li, 2010).. The process of making a decision with respect to an optimal candidate for an executive manager by application of fuzzy logic, in accordance with criteria describing manager's defined and relevant goals, will be explained in this paper.

MANAGER'S GOALS

According to Weihrich and Koontz (Weihrich, Koontz, 1993) the goal of every manager is to create added value (this means profit in business organizations). Clear and measurable goals facilitate measuring of that extra value, successfulness and effectiveness of manager's activities. They (Weihrich, Koontz, 1993) argue that manager's goals express the final results and the totality of goals should be supported by objectives of lower ranks. Moreover, organizations and managers have multiple goals that sometimes may be mutually compatible, so that they do not lead to arising of conflicts in organizations or within a group or even individuals. Managers at different organizational levels are concerned with different types of goals.

According to Rensis (Likert Rensis, 1967), some of manager's goals can be clustered around the factors

Table 1. Manager's goals with relative weights (ώ).

Goal	Manager's goal	Resulting relative weight (ώ)
K1	Wealth	0.20
K2	Prestige	0.22
K3	Professionalism	0.28
K4	Leadership	0.30

(motives) such as leadership, professionalism, prestige, creativity, solidarity, wealth, independence, love, safety, sense of duty and satisfaction. In the process of research into managers' goals in a number of companies 442managers occupying leading positions (who run companies, lead a part of a company or its sector) were surveyed. Each manager had at least ten employees in their work environment doing different work and tasks. The research objective was to establish, based on the survey, the most important manager's goals. 11 manager's goals were investigated in that survey.

The results were statistically processed and statistical estimation of the relative weight (ώ) derived. As this paper aims at presenting a possible approach to the selection of an optimal manager by application of fuzzy logic, the four most important manager's goals with the corresponding resulting relative weights are presented in Table 1. The relative importance of criteria $w_k,\ k=1,\ldots,K$ has been obtained through defuzzification and normalization of fuzzy weights in the following way (Braham, 1989; Coleman, 1997; Deng, 1999):

$$w_i'=\left[\prod_{j=1}^{n}\lambda_j w_{ki}\right]^{1/n}\longrightarrow w_{ki}=\frac{\lambda_j w_{k_i}'}{\sum_{j=1}^{K}\lambda_j w_{k_i}'}=\left[\prod_{j=1}^{n}\lambda_j w_{ki}\right]\left\{\sum_{i=1}^{n}\left[\left[\prod_{j=1}^{n}\lambda_j w_{ki}\right]^{1/n}\right]\right\}^{-1} \quad (1)$$

$$\sum_{j=1}^{K} w_k=1,\ w_k\ \grave{o}\left[0,1\right],\ \lambda\in\left[0,1\right] \quad (2)$$

where λ_j stands for the decision maker's preference, that is, degree of confidence.

Table 1 presents the relative importance of criteria $w_k\ ,k=1,\ldots,K\ (K=5),\quad k=1,\ldots,K(K=5)$ and the degree of influence on the choice of the manager. According to the conducted survey, the most important manager's goals are wealth, prestige, professionalism and leadership (Table 1). The stated goals will represent the relevant criteria (Ki), based on which an optimal choice of the manager through application of fuzzy logic and fuzzy systems can be made in the selection process for an executive position (Chaterjee, 2005; Snoveden, 1999, Ulrich and Yeuang, 1989).

BASIC CONCEPTS OF FUZZY LOGIC AND FUZZY SETS

The basis of this field was formed by Professor Lofti Zadeh (1965). Professor Lofti Zadeh is considered the founder of fuzzy logic. According to Professor Zadeh, fuzzy logic has two different meanings. In the narrow ense, fuzzy logic is a logic system that is an extension of classical logic. In a broader sense, fuzzy logic is mostly a synonym with the fuzzy set theory: the theory that refers to the class of objects with unclear borders, whose membership is measured in specific degrees. It is of great importance to recognize that fuzzy logic is different from traditional logic systems. Fuzzy logic is very close to human perception. In its essence, fuzzy logic has many-valued logic that admits some medium values between traditional state-ments: yes/no, true/false, white/black. Fuzzy logic draws on the experience of experts in the form of linguistic if-then rules. In our example, it will be used to demonstrate the impact of input criteria (K1-K4) on preferences in making the decision on the choice of the optimal manager.

In the last decade, fuzzy set theory has been successfully applied in many different areas of engineering including automatic control, system identification, pattern recognition, design of structures, structural modeling and many more (Adam E. Gaweda, 2003) . The property that makes fuzzy set theory particularly interesting is its ability to handle the imprecision inherently present in a system. Fuzzy reasoning becomes a powerful tool for solving problems when human expert knowledge is available. Even more attractive is the idea of utilizing fuzzy set theory in data driven extraction of easy to understand rule-based models (Adam E. Gaweda, 2003).

In a more general context, this concept is based on the fact that certain fuzzy systems possess the universal approximation property (Wang, 1992). For the most complex systems where a few numerical data exist and

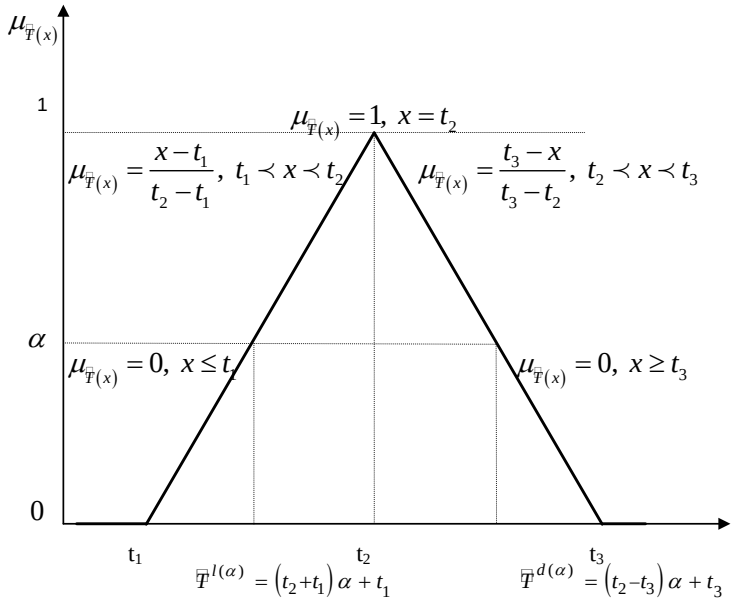

Figure 1. Fuzzy set membership function.

where only ambiguous and imprecise information may be available, fuzzy reasoning provides a way to understand system behavior by allowing us to interpolate approximately between observed input and output situations.

The imprecision in fuzzy models is generally quite high (Ross, 1997). Numerous examples of fuzzy and neuro-fuzzy systems, capable of data-driven function approximation can be found in literature (Jang et all, 1997). Pamučar et al (2011) developed fuzzy logical system that presents support to decision making process in military organization. By modelling of fuzzy logic systems and training of the neuro-fuzzy model, very powerful tools for decision making, based on experiential knowledge of the officers of the Armed Forces of Serbia, are created.

The literature of optimization has been done by researchers such as: Zhang et al. (1998), and recent applications also have been done by Swanson and White (1997a), Darbellay and Slama (2000) and Qi (2001), but despite of the power and of these models, the function of neural network models in Predictive experiment is combinatory (Zhang et al., 1998) In the field of economic data, Swanson and White (1997b), studied performance of neural network models in predicting macroeconomic time series.

In the U.S. Moody et al. (1993), by focusing on integration of production in industry, understood that the neural network model, in the horizon of 6 months and more, is preferred to the linear model. Tkacz (2001) showed that during a year, production of Gross domestic of Canada, by neural network, is predicted well than linear models. In other different applications, Qi (2001) showed that the neural network models are helpful in predicting binary variable of economic crisis.

In terms of combination, Fuzzy logic of Fuzzy neural networks, lots of researches have been done. Kuo et al. (2001), ANN have offered an appropriate Fuzzy inferences system by a Fuzzy modeling "Takagi-Sugeno". The first task in fuzzy set design is to define the membership function: This function shows to what degree $x \in A$ meets the condition of membership to set A. In classical logic there are clearly established rules that define the boundaries of membership of a certain element to a set and set apart those elements that are not included in the set. We can say that in this case there are two possibilities, which are, either the given elements is included or not included in the specific set. That given element x is included in set A can be mathematically described by means of membership function $\mu_A(x)$ in the following way:

$$\mu_A(x) = \begin{cases} 1; & x \in A \\ 0; & x \notin A \end{cases} \qquad (3)$$

Formally, a fuzzy set is defined as a set of ordered pairs:

$$A = \{x, \mu_A(x) \mid x \in X\} \qquad (4)$$

where $\mu_A(x)$ is a degree of membership of element x to set A.

In fuzzy theory, choice of membership function and the range of discourse are usually made on the basis of subjective assessment or experience. Membership

functions may take different shapes. Fuzzy numbers with membership functions: triangular, trapezoid, Gauss curve are most often used. Figure 1 shows the fuzzy set membership function which is most frequently used in work. As shown in Figure 1, the membership function for the given fuzzy set is defined as:

$$\mu_T(x)=\begin{Bmatrix} 0, & 0<x<t_1 \\ (x-t_1)/(t_2-t_1), & t_1\le x\le t_2 \\ (t_3-x)/(t_3-t_2), & t_2\le x\le t_3 \\ 0, & x>t_3 \end{Bmatrix} \quad (5)$$

MODELLING OF FUZZY SYSTEMS FOR EVALUATION OF CRITERIA RELATED TO CHOICE OF OPTIMAL MANAGER

The main parts of each fuzzy logic system are: fuzzification, rules, conclusion and defuzzification. The notion of fuzzification implies the representation of input values in such a way that they can be applicable in fuzzy logic. In other words, fuzzification is used for mapping numeric input values onto a fuzzy set:

$$F \;:\; X \to X^{FUZ} \quad (6)$$

Where all fuzzy sets which can be defined on domain x are marked as X^{FUZ}.

The following part is rules or as some name it rule base. The problem posed to a fuzzy system is how to transfer expert linguistic knowledge into it. This means that the way how input values are mapped onto output values is to be found. The basic way to achieve this goal is a list of so called IF-THEN statements which are named rules. The set of these rules is called the rule base. Their order is not important since they are executed in parallel. Rules are executed through the mechanism of approximate reasoning. Approximate reasoning is a form of fuzzy logic which contains a set of rules for reasoning whose premises are fuzzy propositions. Each rule contains an assumption (if part) and a consequence (then part). Each assumption may have many parts, depending on the number of input values. The rules are interconnected by the expression “else (or)”. The operations of union, intersection and complement have their equivalents in fuzzy logic represented by conjunctions "and", "or" and "not". By combining them, complex rules can be constructed. The maximum number of rules is limited by the number of input values, as well as by the number of linguistic variables they can take. If there are A input values, and each of them take B linguistic variables, the maximum number of rules which can be generated is b^a. The rules using „if-then” format can be generally presented as follows:

1. If A is small and B is small, then C is small 2. If A is small and B is medium, then C is medium

In reality, the most frequent input values are represented by numbers, in which case the output value is also obtained in a numerical form. In a fuzzy system, on the other hand, the given system is described verbally (qualitatively) through production rules. For that reason, numerical values are converted (fuzzified) first by application of fuzzy logical operations, and then they are processed by the mechanism of approximate reasoning in the fuzzy system through the phases of aggregation, activation and accumulation (Pamučar, 2009). The numerical output value is obtained by defuzzification process. Figure 2 presents the process of approximate reasoning. The criteria for the selection of an optimal manager (decision preference) are in fact the goals which that manager has to attain. Each manager can be assessed in a different way by the HR department in accordance with the assessors’ estimation. The candidates are assessed against the following criteria (goals): K1–wealth; K2–prestige; K3 –professionalism; and K4 – leadership. The values of input criteria are represented by numbers. The universes of discourse range within a numerical interval of 0 to 10, given the assumption that the HR department will use a marking scheme with grades 1 to 10 for each candidate.

The value of output variable *decision preference* for choice of an optimal manager will fall within the interval of 0 to 1. Each criterion in the fuzzy model has three linguistic values, and they are:

(a) Wealth (poor, good, excellent)
(b) Prestige (poor, good, excellent)
(c) Professionalism (poor, good, excellent)
(d) Leadership (poor, good, excellent)

Output variable *decision preference* has values: poor, good, very good, excellent. Based on the written concept of the model, conditions are created for the given system to be modelled as a complex fuzzy system (Figure 3). For the specified criteria based on which an optimal manager will be chosen by application of fuzzy logic against the goals (assessment against criteria), the membership function of input and output linguistic variables are specified. The choice of the shape of the membership function and universe of discourse is a very important phase in fuzzy set modelling. The membership function of the Gauss curve has been selected for this fuzzy system. Linguistic variable – *criterion wealth* has Gaussian shapes of membership functions of linguistic values with the following parameters: poor rating (2.1 to 1.53), good rating (1.8 to 4) and excellent rating (1.36 to 9.39). It should be noted that the linguistic evaluation, the value for good rating, is defined on the basis of the comparativeThe relation between the relative weight of this criteria and the table, in relation to the marking scheme 1 to 10.

Linguistic variable – *criterion prestige* has Gaussian shapes of membership functions of linguistic values with the following parameters: poor rating (2.37 to 0.95), good

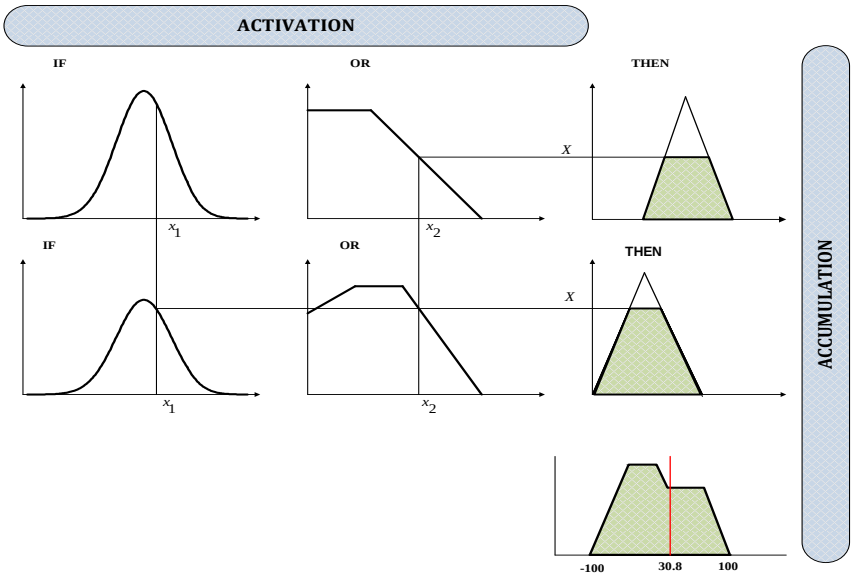

Figure 2. Graphical representation of the process of approximate reasoning.

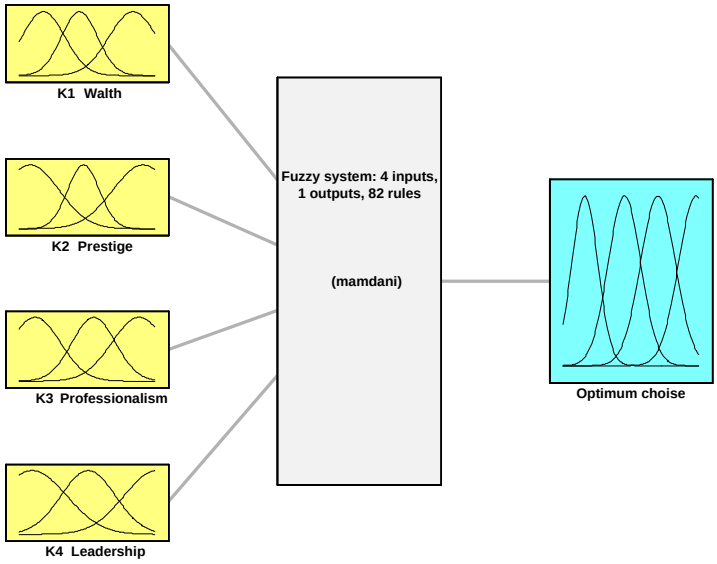

Figure 3. An overview of general model of a fuzzy system.

rating (1.167 to 4.83) and excellent rating (2.23 to 9.55). It should be noted that the linguistic evaluation, the value for good rating, is defined on the basis of the comparative relation between the relative weight of this criteria and the table, in relation to the marking scheme 1 to 10. Linguistic variable – *criterion professionalism* has Gaussian shapes of membership functions of linguistic values with the following parameters: poor rating (2.187 to 1.75), good rating (1.6 to 5.5) and excellent rating (2 to 8.83). It should be noted that the linguistic evaluation, the value for good rating, is defined on the basis of the comparative relation between the relative weight of this criteria and the table, in relation to the marking scheme 1 to 10.

Linguistic variable – *criterion leadership* has Gaussian shapes of membership function of linguistic values with the following parameters: poor rating (2.54 to 0.9), good rating (2 to 7) and excellent rating (2.4 to 9). It should be noted that the linguistic evaluation, the value for good rating, is defined on the basis of the comparative relation between the relative weight of this criteria and the table, in relation to the marking scheme 1 to 10. The following Figures (4, 5, 6, and 7) show the input membership functions. Output linguistic variable – decision preference or optimal choice (Figure 8) also has the shape of the

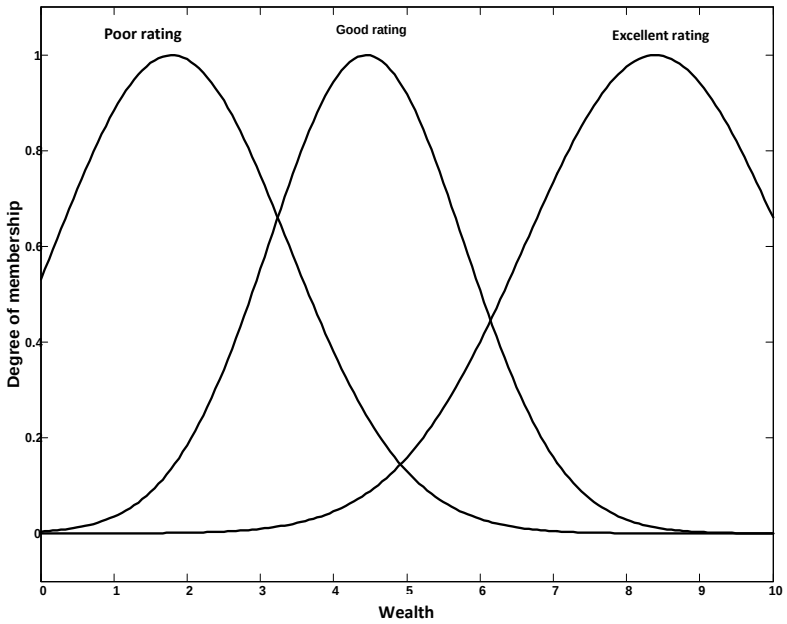

Figure 4. Input membership function for criterion *Wealth.*

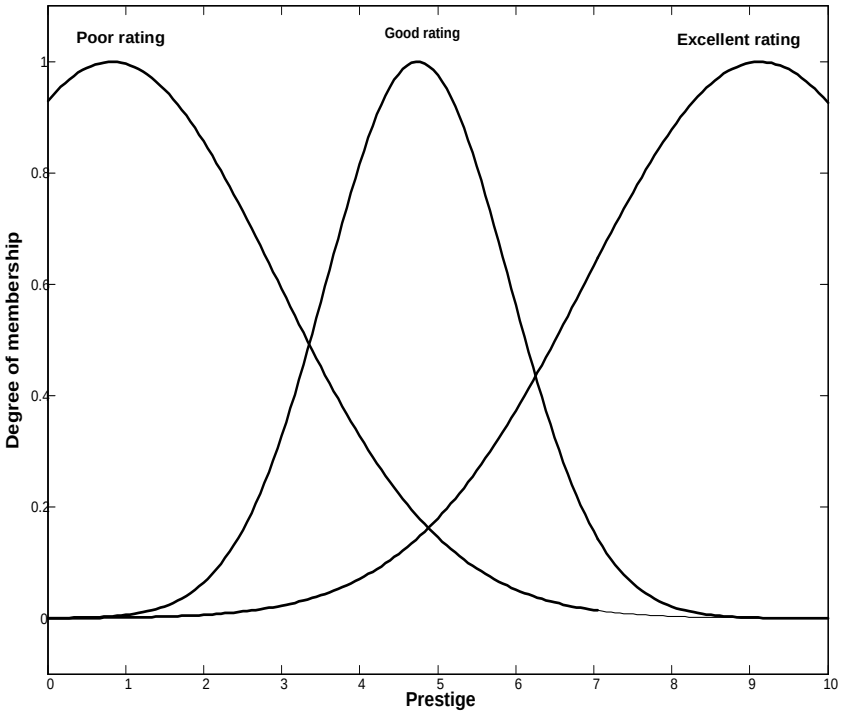

Figure 5. Input membership function for criterion *Prestige.*

Gaussian membership function of linguistic values with the following parameters: poor rating (0.19 to 0.1608), good rating (0.15 to 0.425), very good rating (0.14 to 0.7) and excellent rating (0.144 to 0.98). The following figure shows the output membership function – *decision preference*. Linguistic rules have to be created as a link between the input and the output of the fuzzy system. The purpose of all the rules to be created is to assess and optimize “the output results”.

In this paper, considering the presence of four linguistic variables A (criteria) with three linguistic values B each, the number of rules is $3^4 = 81$ rules. One of the created rules reads: Rules no. 9: IF K1 (poor rating) and K2 (poor rating) and K3 (excellent rating) and K4 (excellent rating).

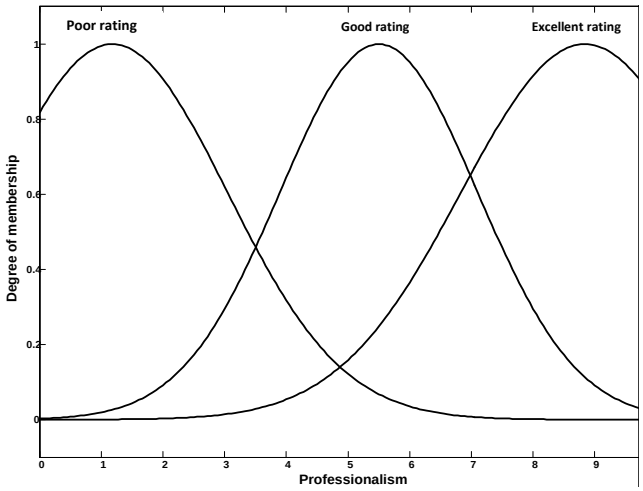

Figure 6. Input membership function for criterion *Professionalism.*

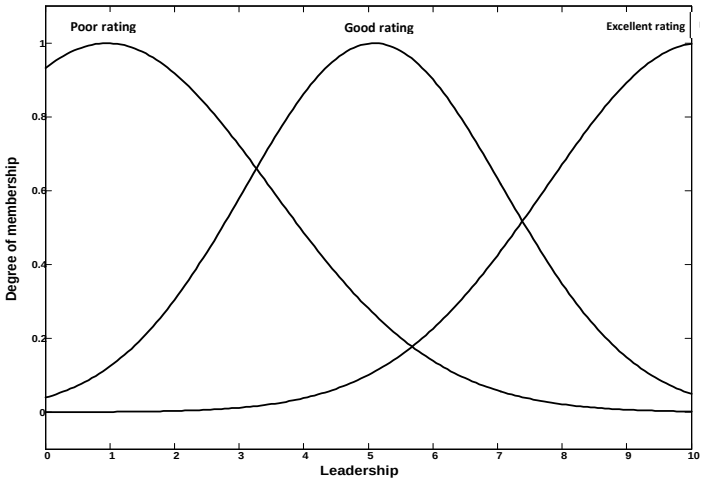

Figure 7. Input membership function for criterion *Leadership.*

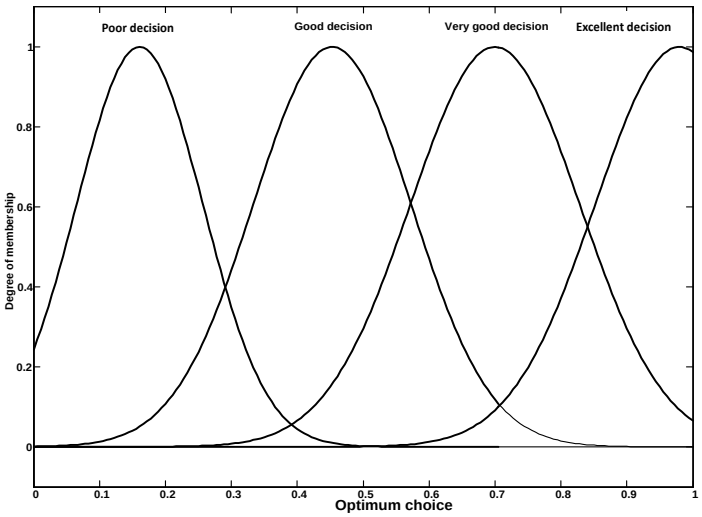

Figure 8. Output membership function – *Decision preference.*

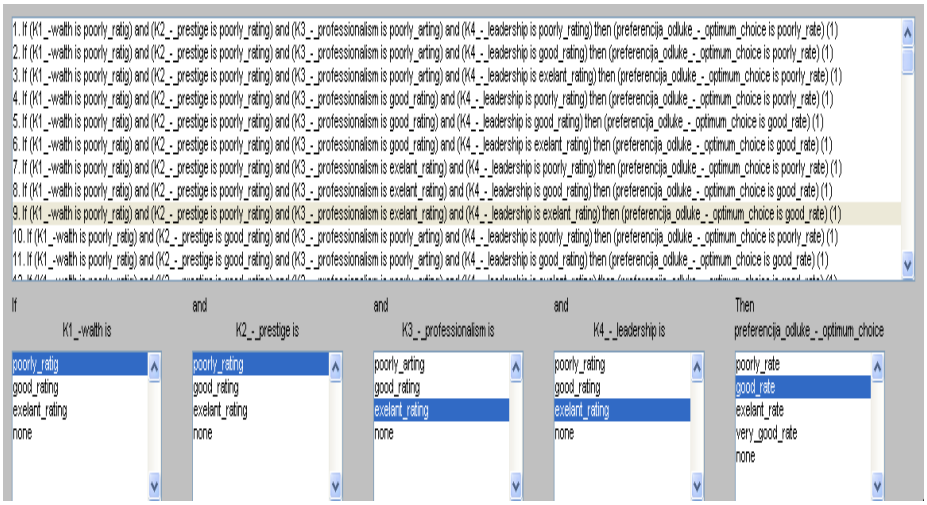

Figure 9. Base of fuzzy logic system rules.

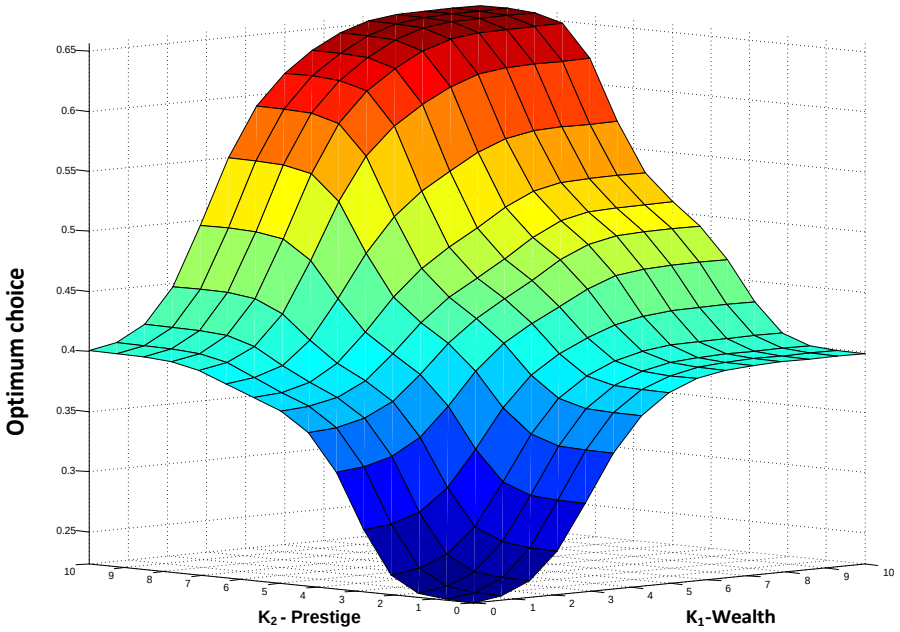

Figure 10. The relation between criteria K_1 and K_2.

then (output variable optimal choice is a good decision); Rule no. 78: IF K1 (poor rating) And K2 (poor rating) and K3 (excellent rating) and K4 (excellent (excellent rating). Then (output variable optimal choice is a good decision). Figure 9 shows the base of the sets of the created rulesThe Centorid model was used for defuzzification of the system. The following formula was applied:

$$a = \frac{\sum_{i=1}^{K} p_i \int_u \mu_B(u)du}{\sum_{i=1}^{K} \int_u \mu_B(u)du} \quad (7)$$

where K stands for the number of rules, p_i for the centre of plane μ_B (the membership function of set B), which is the consequence of *i*-rule. The following graphs depict sets of possible solutions (three dimensional fuzzy system transfer function). The relation between criterion K-1 Wealth and criterion K-2 Prestige is shown in Figure 10. The relation between criterion K-2 Prestige and criterion K-4 Leadership is shown in Figure 11. The relation between criterion K-3 Professionalism and criterion K-4 Leadership is shown in Figure 12. The relation between criterion K-1 Wealth and criterion K-3 Professionalism is shown in Figure 13.

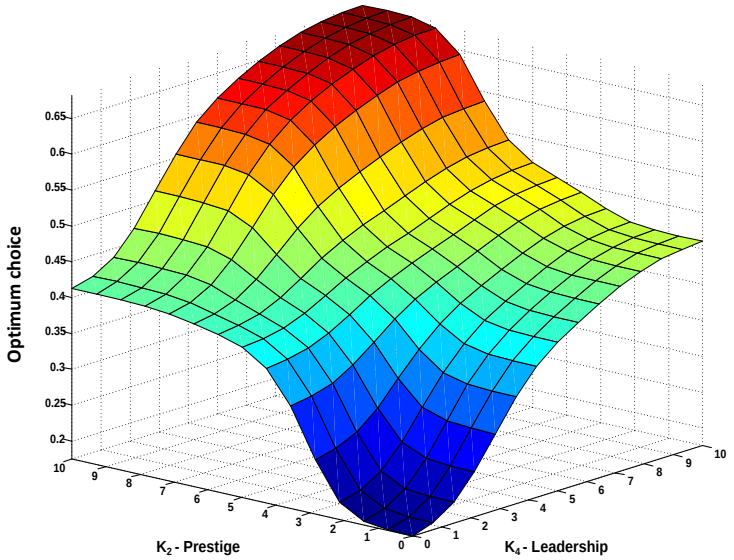

Figure 11. The relation between criteria K_2 and K_4.

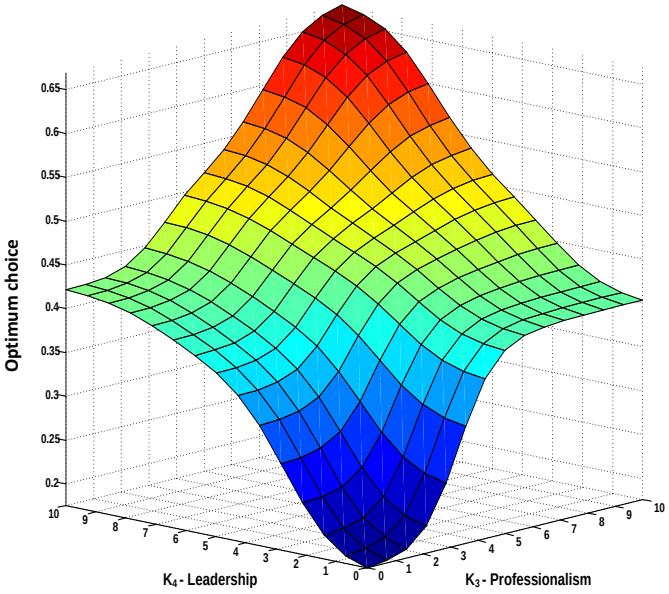

Figure 12. The relation between criteria K_3 and K_4.

TESTING OF FUZZY SYSTEM ON THE CHOICE OF OPTIMAL MANAGER AGAINST GOALS

Practical application of a model is a logical concluding phase of the subject research. The suggested model, based on fuzzy logic, can be applied in the cases where an adequate manager for an executive position in a company should be selected, and among many candidates only one has to be chosen. The human resource department is responsible for selection. They assess and evaluate candidates for the manager's position based on qualifications and competences, but also against the candidate's goals (criteria K1 to K4 in this case). The HR department evaluate each individual candidate applying 1 to 10 grading scheme for each suggested criterion, and take the arithmetic mean grade Xisr for the evaluated value.

An example with five candidates applying for the same job who have been assessed against the manager's goals is shown in the following table (Table 2). The average grades are shown as the arithmetic mean grade (X*isr*) awarded to the candidate by the evaluating department. After applying the formed model, the following results (Table 3) have been obtained.

According to the given results, the most suitable candidate for an executive manager, by applying the model.

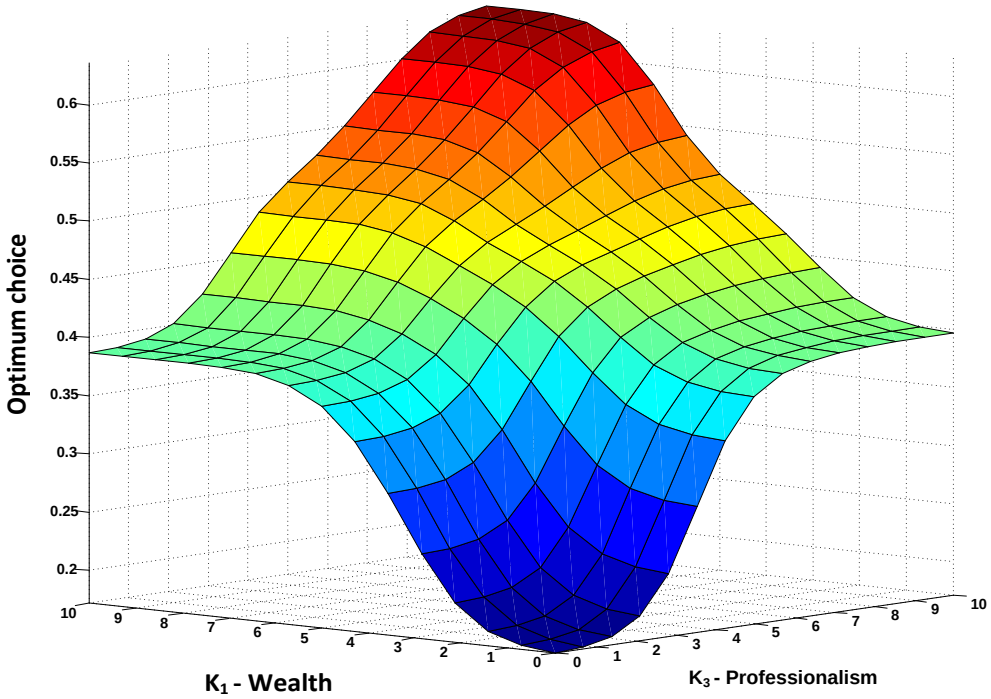

Figure 13. The relationship between criteria K_1 and K_3.

Table 2. Mean values of candidates' grades against criteria.

Candidate	Criterion K1 wealth (grade)	Criterion K2 prestige (grade)	Criterion K3 professionalism (grade)	Criterion K4 leadership (grade)
A_1	6.4	5.6	7.0	8.0
A_2	7.0	4.5	6.5	7.0
A_3	8.0	6.5	4.5	8.0
A_4	5.0	7.0	8.0	4.0
A_5	5.5	3.0	9.0	9.0
A_6	4.5	8.0	9.0	8.3
A_7	5.1	7.1	7.2	8.4
A_8	8.3	2.4	7.7	6.1
A_9	7	3.5	7.2	9.4
A_{10}	9.9	9.9	5.1	7.9
A_{11}	6.4	5.3	6.6	7.4
A_{12}	8.5	5.5	7.7	7.6
A_{13}	9.2	6.2	9.6	5.4
A_{14}	7.9	3.5	8.7	6.3
A_{15}	9.7	4	3.3	5.3
A_{16}	5.6	8.8	6.1	9.6
A_{17}	5.3	5.4	9.9	6.9
A_{18}	9.5	9.9	6.8	5.5
A_{19}	6.7	8.8	8.7	6.1
A_{20}	9.2	4.1	4.7	7.7

of fuzzy logic against the manager's goals (the observed criteria), is candidate A3, considering the highest degree of preference obtained as the output through the application of the created fuzzy model

Table 3. Decision preference by application of fuzzy model.

Candidate	Preferential decision - optimal decision					Final rank
	$W_{P_{A_i}}$	$\alpha = 0.35$	$\alpha = 0.5$	$\alpha = 1$	$\sqrt[3]{\prod_{k=1}^{3} W_{P_{A_i}}}$	
A_1	0.54	0.49	0.54	0.72	0.58	15
A_2	0.55	0.50	0.55	0.74	0.60	13
A_3	0.62	0.56	0.62	0.82	0.67	9
A_4	0.42	0.38	0.42	0.56	0.45	19
A_5	0.46	0.41	0.46	0.61	0.49	18
A_6	0.53	0.48	0.53	0.71	0.57	16
A_7	0.71	0.64	0.71	0.95	0.77	3
A_8	0.49	0.44	0.49	0.66	0.53	17
A_9	0.63	0.57	0.63	0.84	0.68	8
A_{10}	0.76	0.68	0.76	0.98	0.82	1
A_{11}	0.59	0.53	0.59	0.79	0.64	10
A_{12}	0.68	0.61	0.68	0.90	0.73	7
A_{13}	0.69	0.62	0.69	0.92	0.74	6
A_{14}	0.59	0.53	0.59	0.78	0.63	11
A_{15}	0.42	0.37	0.42	0.55	0.45	19
A_{16}	0.72	0.64	0.72	0.95	0.77	3
A_{17}	0.58	0.52	0.58	0.78	0.63	11
A_{18}	0.72	0.64	0.72	0.95	0.77	3
A_{19}	0.75	0.68	0.75	0.97	0.81	2
A_{20}	0.56	0.50	0.56	0.74	0.60	13

CONCLUSION

In most cases, decision making process comes down to experiential knowledge of the person who makes decisions. As there is the possibility that evaluators or decision makers may take a subjective approach to a candidate in decision making process, there is an objective possibility that a wrong choice can be made. This paper has demonstrated that candidates for top positions in a company may be selected through application of advanced models based on fuzzy logic in accordance with the chosen criteria.

The manager's goals relevant to this research and example are: wealth, professionalism, leadership and prestige. Undoubtedly, there are more criteria, that is, manager's goals based on which a candidate can be assessed, but the objective we pursued in this paper was to present the application of fuzzy logic in making a choice and reaching a preferential solution.

Having analyzed the output results, we may conclude that a developed fuzzy system can be successfully used for assessing candidates against their goals and for creation of a decision making strategy in choosing the candidate.

In future papers, neuron networks can be used for the same purposes to upgrade this research.

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