A NON-CLASSICAL APPROACH IN SELECTION OF A FEASIBLE CANDIDATE FOR CONTESTING IN AN ELECTION USING FUZZY LOGIC

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Abstract: When it comes to dealing with complicated decision-making situations that also entails emotional circumstances, traditional reasoning and conventional theories are ineffective. Here, a strong emphasis on the choice of candidates depending on the degree of inclusivity and decentralization of the electorate is considered. According to certain studies, the highest level of management typically makes instinctive choices when choosing candidates for political parties, which highlights the significance for developing a fresh, effective methodology.

The present investigation identifies the qualitative traits and the degree to which they are significant for the selection of candidates by political parties. Fuzzy logic approach is used to analyse the candidate selection process, which includes ambiguous inputs, and a candidate's ultimate score has been quantified. The formal regulations established by parties that limit the pool of candidates and the (informal) preferences of selectors that influence who is selected are the two angles from which the selection criteria are examined in this study. It has been demonstrated that the model produced some plausible and encouraging results, which may allow future research to produce more optimized and improved models for related objectives.

Keywords: Fuzzy Logic, Candidate Selection, Political Parties, Qualitative Weights

INTRODUCTION

Elections have been used since the time of the ancient Greeks and Romans to select rulers who will faithfully govern their subjects. Voters casted their ballots in rope-bound sealed boxes even during the Sangama era to select their representatives. The contemporary election, which consists of open elections for government officials, came into existence when the idea of representative government became popular in Western countries at the start of the 17th century. The process through which political parties determine which of their favored candidates will appear on the ballot is known as candidate selection, however this selection process is heavily influenced by their organizational norms/regulations and their personal rapport. Before approving a candidate's candidature and writing their name on the electoral roster, election officials must follow the legal process of nomination.

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To select the most competent candidate for the election, the parties do not have a strong system in place. Political parties act as crucial and essential gatekeepers, whittling down the number of candidates to a tolerable number. The traditional approach is outdated, biased, unethical and unreasonable for predicting the candidates to contest the elections.

The present investigation looked at a practical issue that many political parties are currently facing and that can be swiftly resolved with fuzzy logic. The standard procedures for selecting candidates is a cumbersome task that takes up a long time. A questionnaire is developed to satisfy the electoral process' requirements for the selection of candidates based on the score they receive, which considers a number of elements like the candidate's training, leadership abilities, prior experience, familiarity with local issues, and grassroots work. Based on the fuzzy logic-based answers to the questions, a candidate's application is assessed, and the candidate is either shortlisted, disqualified, or kept on a waiting list. Fuzzy logic controllers are currently very well liked because of their capacity for decision-making similar to that of a human and their power to produce reliable assumptions. They are therefore used to develop incredibly intricate decision-making systems.

CANDIDATE SELECTION PROCESS IN POLITICAL PARTIES

In the present-day democratic structures, individuals' involvement with governmental administration is developed with the assistance of selecting and supervising the government, where these two components are widely acknowledged as being the most important ones in a democracy. In democratic systems, all citizens have an equal say in decisions that affect their rights and interests through a variety of governmental mechanisms, including general and local elections, constitutions, rules, and laws. One of the nations with a representative democracy and parliamentary system of government is India.

Parties have a variety of options for choosing their candidates. They should elect their candidates democratically, according to the law as it stands and the party constitution. However, since there are numerous factors involved in some of the unethical candidate selection processes, strictly adhering to the law may not always be possible. Legislation rarely specifies the method by which candidates should be chosen, and the method will directly affect the depth and scope of the democratic process, particularly if a single party's candidate selection procedure is opaque.

The outdated selection processes are frequently criticized, and intense animosity among the members who did not make the final list could spark a revolt. Additionally, by slinging mud at candidates, the political party's reputation and future could suffer. A new approach has been designed to enhance this procedure, and it outlines the standards for choosing and assessing candidates. Therefore, in the new method, the following factors are considered for selecting a candidate:

1. Behavior:

The most important factor determining a candidate's future is their behaviour. It is classified as follows:

a) Bad, b) Good, c) Better, d) Best.

2. Age

Age affects a person's capacity for labor and level of experience. A person under the age of 25 is not suited for running for office, while those between the ages of 25 and 40 have less

experience but still have good working capacities, and those between the ages of 40 and 65 have both good experience and functioning capacities. This is the best age for running for office; if he is between 60 and 75, he has strong experience but less working capacity, therefore he should have received fewer votes than someone who is 60 years old. If a person is above 75 today, they should either leave politics or be given extremely rare opportunities.
a) Age less than 25, b) Age greater than 25 but less than 40, c) Age greater than 40 but less than 60, d) Age greater than 60

3. Character
Honesty, reliability, dependability, sincerity, and a strong adherence to his principles are the best traits of a politician. He makes choices and takes accountability for his deeds and words.
a) Honesty, b) Morality, c)Empathy, d)Integrity

4. Track Record
The most well-known and frequently used phrase we hear from the general Indian population is that after the elections, we don't get to see the politicians who renege on their obligations. Here, we're going to evaluate the incumbent politicians' prior performance so that we can decide whether or not to nominate them for another term.
a) Bad less than 25%, b) Average greater than 25% but less than 50%, c) Good greater than 50% but less than 75%, d)Very Good greater than 75% but less than 100%

5. Education
Candidates are given some weight in part due to the idea that educated candidates are better able to deliver good governance and are aware of current global events. We can assign a value of "very high" to a candidate who has completed a postgraduate program, "high" to a candidate who has completed a graduate program "low" to a candidate who has not completed a graduate program, and "very low" to a candidate who is uneducated. We can form the categories as given below: a) Not Educated, b) Education before graduation, c) Education till graduation, d) Education after graduation.

3. IMPLEMENTATION

In the first section of this work, the criteria and sub-criteria were defined, and their weights or significance levels were established. Then, two matrices are created using these weights, the political party committee's evaluation criteria, and pertinent survey results. These matrices are subjected to the "min-max" operation, and the pertinent fuzzy values are assessed.

Finally, the Centroid method is used to defuzzify these values, and the crisp score for each candidate is obtained. The assumption behind the model in this study is that the operations employed in classical set theory can also be used in fuzzy set theory. As a result, a final fuzzy score is evaluated using the intersection and union operations.

The union operation in fuzzy sets could be represented as follows:

For $R \subseteq AxB$ and $S \subseteq AxB$ and $\forall(x,y) \in AxB$ then;

$\mu R \cup S(x,y) = \max[\mu R(x,y), \mu s(x,y)] = \mu R(x,y) \vee \mu S(x,y)$.

In general, "$\vee$" sign is used for the maximum operator. Similarly, intersection operation could be defined as follows;

for $R \subseteq AxB$ and $S \subseteq AxB$ and $\forall (x,y) \in AxB$

$\mu r \cap s(x,y) = \min[\mu R(x,y), \mu s(x,y)] = \mu R(x,y) \wedge \mu S(x,y)$.

It should be noted that the minimal operator is denoted by the symbol "∧". With "min-max" operators, union and intersection operations could be set up. These procedures fall under the category of the min-max approach.

In the final phase of our model, the Centroid method is used for defuzzification which can be formulated as; $Z = \sum_{(i=1)} [\![\mu(Zi)(Zi) / \sum_{(i=1)} [\![\mu Zi]\!]]\!]$

This operator can be used to convert fuzzy data and fuzzy values into crisp values. The model in this case is treated using a similar manner. Additionally, it should be noted that the weighted average mean scores are calculated using the generic fuzzy means method; however, the fuzzy arithmetic means may be calculated using some other methodologies.

3. 1Applying and Assessing qualitative weights

This section includes information on data generation, data transformation, and the calculation of qualitative weights and scores. In the beginning, a questionnaire form is developed in accordance with the restrictions and specifications set forth by some political party specialists through the polling process. The names "Criteria" and "Sub-criteria" in Table 1 indicate each and every question utilized in this form. Then, a survey is conducted using this form among 40 people who were political party members. Each survey respondent assigned a score between 0 and 100 for each of the evaluation criteria, which should add up to 100 in total. In a similar manner, they assigned a score between 0 and 100 to each sub-criteria, resulting in a sum of 100 for each sub-criteria group that fell under that particular criterion. The mean scores (significance levels) for each of the criteria and the accompanying sub-criteria are calculated after compiling the findings from each of the forty survey respondents. Table 1 lists the criteria, together with the sub-criteria items that relate to them, and the accompanying mean scores.

The sub-criteria mean scores in Table 1 could be used to determine the weight matrices for each of the sub-criteria "Human Skills and Qualifications," "General Skills," "Urban Strategies," "Personal Characteristics," and "Interaction between Candidate and Political Party." These weight matrices are denoted below:

A1 = (28, 22, 27, 23), A2 = (23, 24, 19, 16, 18), A3 = (26, 23, 18, 33), A4 = (34, 23, 32, 11), A5 = (25, 24, 31, 20).

Similarly, the generalized weight matrix A is obtained from the criteria mean scores as follows:
A = (22, 23, 18, 21, 16)

It was anticipated that there is a party committee with five members in order to get the outcomes for the implementation phase. The members were expected to rate each candidate's characteristics on a scale of 1 to 5 (Very High = 5, High = 4, Medium = 3, Low = 2, Very Low = 1). In this manner, the matrices are created from the assessments of these party members, and the outcomes are assessed by computing the union of these matrices. It should be mentioned that the member set size employed in this approach is not a necessary quantity or a restriction. This value was arbitrarily selected for this study, and it may be modified to other potential values in future investigations of a similar nature.

4. FUZZY METHODOLOGY AND RESULTS

This section explains the processes of fuzzification and defuzzification that produce the quantitative modeling and derivation of the corresponding outcomes. Table 2 displays an example of a candidate's ratings from the party committee members. Fuzzy logic methods must

be used to determine the candidate's ultimate cumulative score in relation to these scores. To do this, the scores for each of the criteria and any applicable sub-criteria must first be converted into a format suitable for the fuzzy process.

For instance, as shown in Table 3, the candidate receives 5 points from two members and 4 points from the other three members for their "Communication skills" sub-criteria. The remaining sub-criteria are examined in a similar manner. These points can be used to create the fuzzy-number-based matrix shown in Table 4 below.

Thus, the matrix for "Human Skills and Qualifications" could be written as;

B1 = Matrix [(0.4,0.6,0.0,0.0,0.0) (0.2,0.2,0.2,0.2, 0.2) (0.2,0.2,0.2,0.4,0.0) (0.4,0.2,0.2,0.2,0.0)]

Using the same methodology, the other four matrices are to be developed and they are denoted one by one as follows; B1, B2, B3, B4, B5

After this step, each of these matrices is to be processed using the union operation and the weight matrices that is defined in table 5.

Recall that the union operation is defined as below;

$C_i = A_i . B_i$

Matrix [

$C_i = [0.28,0.22,0.27,0.23]$ * (0.4, 0.6, 0.0, 0.0, 0.0) (0.2,0.2,0.2,0.2,0.2) (0.2,0.2,0.2,0.4,0.0) (0.4,0.2, 0.2, 0.2, 0.0)]

C1 = [max{ min(0.28, 0.4), min(0.22, 0.2), min(0.27, 0.2), min(0.23, 0.4) } max{ min(0.28, 0.6), min(0.22, 0.2), min(0.27, 0.2), min(0.23, 0.2) } max{ min(0.28, 0.0), min(0.22, 0.2), min(0.27, 0.2), min(0.23, 0.2) }

max{ min(0.28, 0.0), min(0.22, 0.2), min(0.27, 0.4), min(0.23, 0.2) } max{ min(0.28, 0.0), min(0.22, 0.2), min(0.27, 0.0), min(0.23, 0.0) }]

C1 = (0.28, 0.28, 0.2, 0.27, 0.2)

All the other criteria are evaluated in the same manner as below;

General Skills: C2 = (0.2,0.24,0.2,0.2,0.2)

Urban Strategies:C3 = (0.26,0.33,0.2,0.33,0.0)

Personal Characteristics:

C4 = (0.22,0.23,0.34,0.23, 0.2)

Interaction between Candidate and Political Party: C5 = (0.25,0.31,0.31,0.2,0.0)

Hence, the matrix obtained from these criteria can be denoted as follows;

C = Matrix [(0.28,0.28,0.2,0.27,0.2) (0.2,0.24,0.2, 0.2,0.2) (0.26,0.33,0.2,0.33,0.0) (0.22,0.23,0.34, 0.23,0.2) (0.25,0.31,0.31,0.2,0.0)]

In order to obtain a final fuzzy score for the candidate, a union operation will be applied to general weight matrix A and matrix C. After this operation, Final Fuzzy Score (FFS) is determined.

FFS = A. C = [0.22 0.23, 0.21, 0.22, 0.20]

The values in the matrix show the weights corresponding to the previous qualitative scale for this candidate and they are denoted as below; In the final step, this final fuzzy score matrix will be operated through defuzzification process. Thus, a final score will be determined for the candidate. It should be noted that, after defuzzification, the final score for any candidate can be any quantitative value ranging between 0 and 100. The formula and the calculations are denoted below:

$P = \sum_{i=1}(FFSi).Z / \sum_{i=1} FFSi$
P=(0.22)*20+(0.23)*40+(0.21)*60+(0.22)*80+(0.20)*100/(0.22+0.23+0.21+0.22+0.20)
P = 59.07

After these calculations, the final score of the candidate is found out as 59.07 and this score will be compared with other candidates' scores. Retrieving the scores by filling in the entries denoted in Table 2 and executing the same subsequent steps, the final score for each candidate was obtained.

CONCLUSION

The results show that the model in this study could be a promising alternative for the traditional candidate selection methods in political parties so that the subjectivity, vagueness and qualitative weaknesses could be significantly decreased. It is shown that fuzzification and defuzzification methods can be applied to candidate selection process conveniently. Since, a quantitative, non-ambiguous numerical value can be obtained and assessed for any candidate's political image; clear, objective and efficient comparisons and evaluations could be made for all the candidates in political parties. Hence, this could enable the presidents and the decision makers in the political parties to make correct, non-trivial and reliable strategic decisions. In addition, this would increase the trustworthiness and positive impression of that political party among its members and the citizens. This model also brings forward some promising and interesting topics for further studies. We are planning to implement this model within a web based automated software that calculates the results simultaneously. By this way, the reliability, usability and efficiency of the model could be increased.

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Table 1. Mean Scores of the Candidate Selection Criteria

CRITERIA	MEAN SCORE	SUB-CRITERIA	Sub-criteria Mean Score
Human Skills and Qualifications	22	Communication skills	28
		Positive influence on people	22
		Leadership and persuasion skills	27
		Motivation capability and durability	23
		TOTAL	**100**
General Skills	23	Knowledge level about local and global affairs and issues	23
		Having a powerful and sufficient technical team	24
		Possessing municipality mission and vision	19
		Ability to work in harmony and coordination with NGOs	16
		Educational background and training history about local administration	18
		TOTAL	**100**
Urban Strategies	18	Taking part as sponsor / owner in urban projects	26
		Adding value to urban developments and being successful in representation of the city	23
		Positive relationship with the notables of the city	18
		Knowledge about urban problems and issues	33
		TOTAL	**100**
Personal Characteristics	21	Being able to use resources efficiently and economically	34
		Courage, intelligence and extroversion	23
		Not being involved in notorious acts such as fraud, bribe, embezzlement	32
		Sub-identity notion	11
		TOTAL	**100**
Interaction between Candidate and Political Party	16	Adopt in political party's own mission and vision	25
		Being in harmony with the political party organization	24
		Previous achievements in party tasks	31
		Experience in grassroots projects	20
		TOTAL	**100**

Table 2. Scores given by the Party Committee Members for each of the Candidate Selection Criteria

CRITERIA	SUB-CRITERIA	Scores given by the party committee members				
		M1	M2	M3	M4	m5
Human Skills and Qualifications	Communication skills	5	4	4	4	5
	Positive influence on people	3	5	4	2	1
	Leadership and persuasion skills	5	4	2	3	2
	Motivation capability and durability	5	4	5	3	2
General Skills	Knowledge level about local and global affairs and issues	1	2	3	5	4
	Having a powerful and sufficient technical team	3	4	4	4	5
	Possessing municipality mission and vision	5	5	4	3	4
	Ability to work in harmony and coordination with NGOs	3	3	4	4	5
	Educational background and training history about local administration	3	3	3	2	2

Urban Strategies	Taking part as sponsor / owner in urban projects	3	4	5	4	5
	Adding value to urban development's and being successful in representation of the city	4	4	3	5	5
	Positive relationship with the notables of the city	2	3	3	4	4
	Knowledge about urban problems and issues	5	2	2	4	4
Personal Characteristics	Being able to use resources efficiently and economically	1	4	3	3	3
	Courage, intelligence and extroversion	2	4	2	3	4
	Not being involved in notorious acts such as fraud, bribe, embezzlement	3	4	5	5	1
	Sub-identity notion	3	2	2	3	2
Interaction between Candidate and Political Party	Adopt in political party's own mission and vision	5	4	5	4	3
	Being in harmony with the political party organization	4	5	5	4	3
	Previous achievements in party tasks	4	5	3	4	3
	Experience in grassroots projects	3	3	2	4	4

Table 3. Sample scores for human skills and qualifications

Human Skills and Qualifications	Communication skills	5	4	4	4	5
	Positive influence on people	3	5	4	2	1
	Leadership and persuasion skills	5	4	2	3	2
	Motivation capability and durability	5	4	5	3	2

Table 4. Fuzzification of Human Skills and Qualifications

	Very High	High	Average	Low	Very Low
Communication skills	2 (0.4)	3(0.6)	0(0.0)	0(0.0)	0(0.0)
Positive influence on people	1(0.2)	1(0.2)	1(0.2)	1(0.2)	1(0.2)
Leadership and persuasion skills	1(0.2)	1(0.2)	1(0.2)	2(0.4)	1(0.0)
Motivation capability and durability	2(0.4)	1(0.2)	1(0.2)	1(0.2)	1(0.0)

Table 5. Qualitative Weights of the Candidate

Very High	High	Medium	Low	Very Low
0.22	0.23	0.21	0.22	0.20