

# Fuzzy Expert System for Selecting and Recruiting Personnel

Quashie Duodu  
Department of Mathematics/ICT  
Ada College of Education, Ada

Seidu Kwame Hamidu  
Department of Mathematics/ICT  
Ada College of Education, Ada

## ABSTRACT

Selection and recruitment is a critical decision-making in any organization. The main aim of this research was to develop a multi-portfolio Fuzzy Logic Expert System to aid in recruitment and selection of personnel in an establishment. Case-study was conducted in Kings University College, a private university in Ghana. Fuzzy logical algorithm and flowchart of the algorithm was developed. The algorithm was simulated using MATLAB 7.8.0 (R2009a). Using Chief Security Portfolio, the system was used for selecting a personnel. Fuzzy logic offered accurate and simplified way of recruiting personnel of out of 16 randomly sampled applicant at Kings University College.

## Keywords

Fuzzy variable, linguistic variable, fuzzy decision matrices

## 1. INTRODUCTION

Recruiting a rightful person to fill vacancy in an establishment is a crucial decision process. This is because the person employed undertakes the combination of other factors in the organization to achieve the possible best result. As a result, it is not prudent to allow a person or persons to saddle with due to human shortfall factors such as mood fluctuation, favoritism and inconsistency. Personnel selection process and quality of employees are the engine of every institution, and hence, have always been an important topic for organizations [1]. Much as there is a need for a system to help in the selection of an idea person, there is a need to consider accuracy and simplicity. Again, many researchers have worked on using fuzzy systems as a tool to aid in selecting candidates, they have failed to distinguish the selection criteria of one portfolio to the other. For instance, the requirement for selecting a manager is different from that of a security personnel in a criteria like qualification. Thus making their systems tailored to a specific portfolio recruitment. In this paper, Fuzzy Logic Recruitment Expert System is proposed for a multi-portfolio selection.

## 2. LITERATURE REVIEW

No organization in existence is free from recruitment and placement problems. In dealing with this problem, one group employed ranking and fuzzy logic. They noticed, mathematical models quantify magnitudes that are not always objective hence fuzzy set theory was developed and used. They concluded that fuzzy logic models fit more accurately to managers' thinking when implementing human resources policies [2]. In other research, fuzzy TOPSIS was used as the analytical tool to determine weight of each criterion in personnel selection but ended up that fuzzy theory provides a proper tool to encounter with uncertainties and complex environment [3]. In a conclusion remark by researchers, fuzzy methodology embedded in a fuzzy software tool developed in the Java programming language, observed that their technique

can offer significantly opportunities and chances to achieve the excellence in personnel selection [4]. Others observed that fuzzy method of selection, hamming distance and a Matching Level Index make it possible for candidates to be ranked even when the competences of the ideal candidate have been evaluated only in part [5]. Other researchers believed that interdependencies of factors of personnel selection should be considered [6]. Others noted that fuzzy expert system is capable for evaluating personnel capabilities [7]. Another researchers opine that two-phase multiple criteria stochastic dynamic programming approach using analytic hierarchy process (AHP) and dynamic programming (DP) should be used for personnel selection [8]. Carefully choosing weights for skills and tasks in advance of evaluation of applications, the fuzzy method achieves a rational basis for assessment [9]. Conclusively, others believe fuzzy Logic Model leads to thorough capacity assessment of personnel [10]. Another group of researchers attempted solving the problem of personnel selection by using PROMETHEE, Fuzzy Logic and Weighted Average [11]. It can be noted that many researchers blend fuzzy logic with other techniques in solving the problem of personnel selection making their systems complex. In this paper, only fuzzy logic is used to address personnel selection problems.

## 3. METHODOLOGY

### 3.1 Data Collection

This research is a case study conducted at Kings University College in Ghana with staff and student population of 1093. Purposive sampling of 9 human resource experts were selected and used to capture the knowledge base of the system using data collection instruments like questionnaire, interview and consultation. Fuzzy variables, linguistic variables and fuzzy decision matrices were designed. Algorithm and flowchart of the algorithm was developed. The algorithm was simulated using MATLAB 7.8.0 (R2009a)

### 3.2 Model of the Existing Personnel Selection

The fig 1 below shows how an existing model is used by human resource managers recruit and place personnel in the organization.s

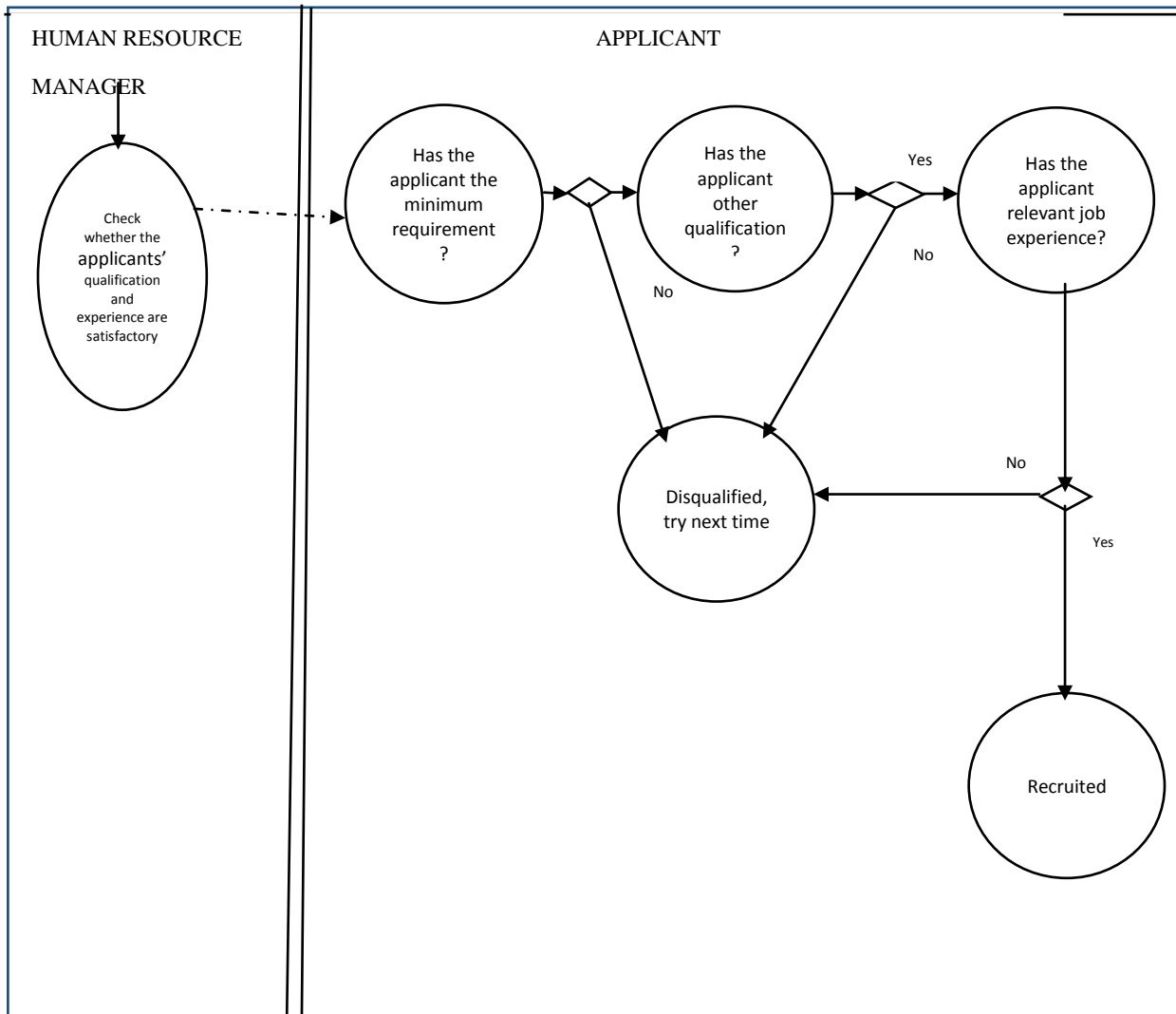


Fig 1: Model of the existing personnel selection

### 3.3 Model of the Designed System' Personnel Selection

The fig 2 below shows how the designed Fuzzy Logic Recruitment Expert System is used to recruit and place personnel in the organization.

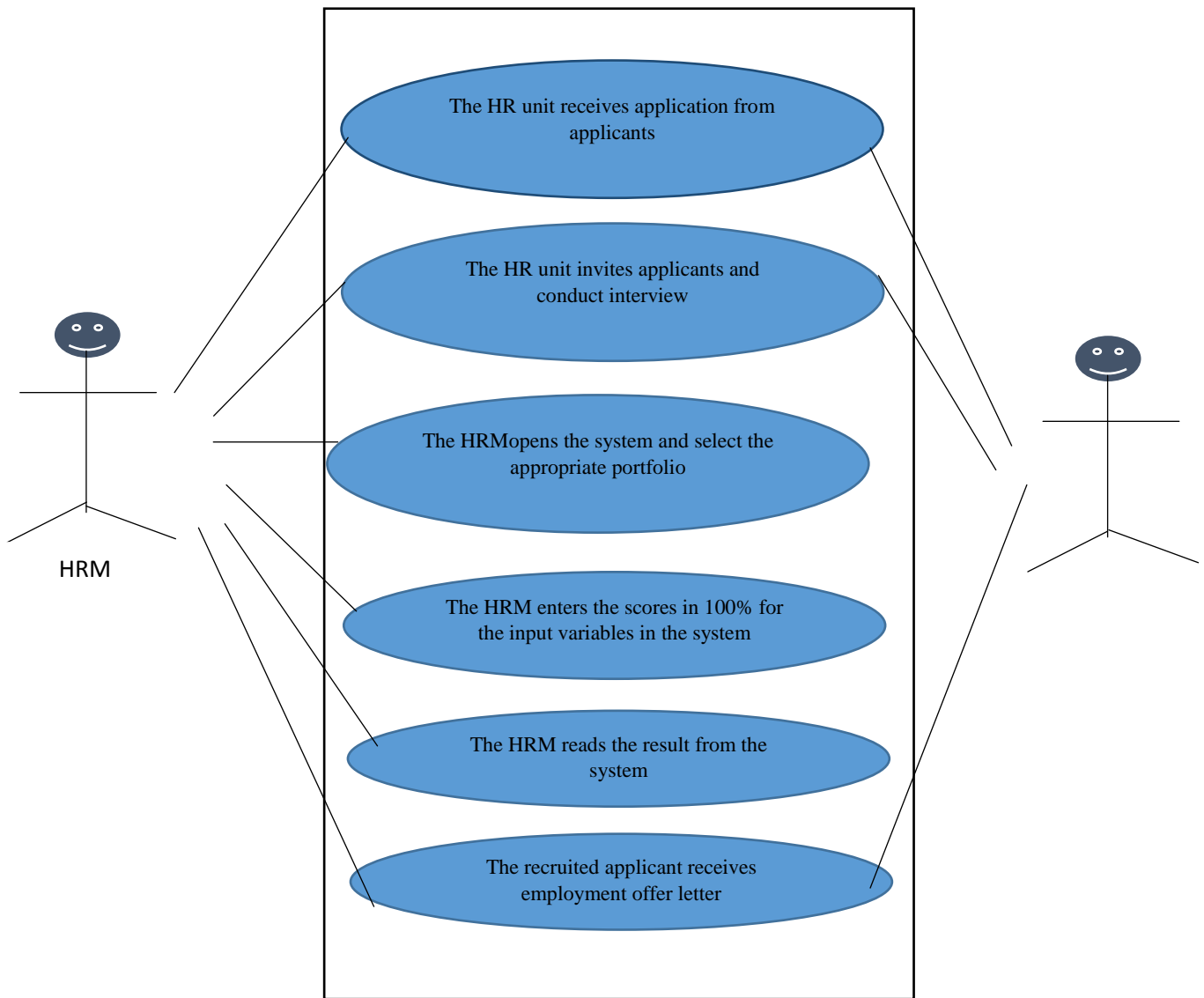


Fig 2: Model of the designed systems' selection

## 4 IMPLEMENTATION

### 4.1 Structure of the ExpertSystem

The fig 3 below shows the architecture of the Fuzzy Logic Recruitment Expert System. The main components of the system are fuzzification, knowledge base, inference engine, and defuzzification.

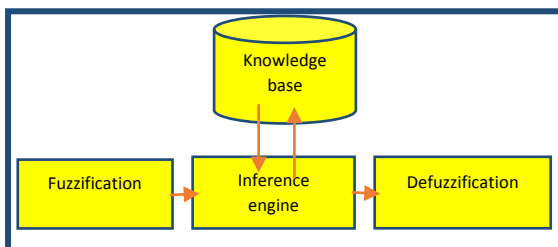


Fig 3: Architecture of the Fuzzy Recruitment System

#### 4.1.1 Fuzzification

The crisp input entered is mapped to its linguistic variable using membership function of each fuzzy variable. Nine fuzzy variables namely qualification, relevance experience,

experience duration, interview score, age, computer skills, foreign language, communication skills, driving license were used with each variable having four linguistic variables, namely low, moderate, high, excellent. Fig4, and fig5 show triangular membership function plots of qualification, and relevance experience of mechanic portfolio from MATLAB 7.8.0

#### 4.1.2 KnowledgeBase

The Knowledge base is where the captured human expert is store for reference by the inference engine. The fuzzy decision matrices uses forward chaining and logical AND operator.

#### 4.1.3 Inference Engine

Inference engine matches the fuzzified inputs with the fuzzy decision matrices in the knowledge base to provide an output. Samples of the fuzzy decision matrices of Mechanic portfolio are shown below:

T1: if  $\min(\text{qualification}(\text{low}), \text{R\_experience}(\text{Low}), \text{D\_experience}(\text{low}), \text{interview}(\text{low}), \text{computer}(\text{low}), \text{age}(\text{low}), \text{F\_language}(\text{low}), \text{D\_license}(\text{low}))$  then  $\text{Recruitment\_Info} = \text{"Rejected"}$  and  $\text{Placement\_Info} = \text{"No placement"}$

T2: if min(qualification(excellent),  
R\_experience(excellent),D\_experience(high),  
interview(excellent), age(excellent), F\_language(excellent),  
com\_skills(excellent),D\_lincese(excellent))then  
Recruitment\_Info="Recruited" and Placement\_Infor =  
"Placedin the office")

#### 4.1.4 Defuzzification

Here, crisp output is produced from the Fuzzy Logic Recruitment Expert System.

### 4.2 The Algorithm

The algorithm of the Fuzzy Logic Recruitment Expert system is as follows:

1. Start
2. Select the specific portfolio
3. Read the input data of the fuzzy variables;
4. Evaluate the variables against the fuzzy inference system;
  - a. Construct membership function of each input variable;
  - b. Match the function of the variables with the fuzzy decision matrix in the KB;
  - c. Determine whether the applicant qualifies;
5. If the applicant qualified, then
  - a. Display recruit and place the applicant;
 Else
  - b. Display "Rejected or pending";
6. Stop

### 4.3 Flowchart of the Algorithm

The flowchart of the fuzzy logic algorithm is shown in fig 6

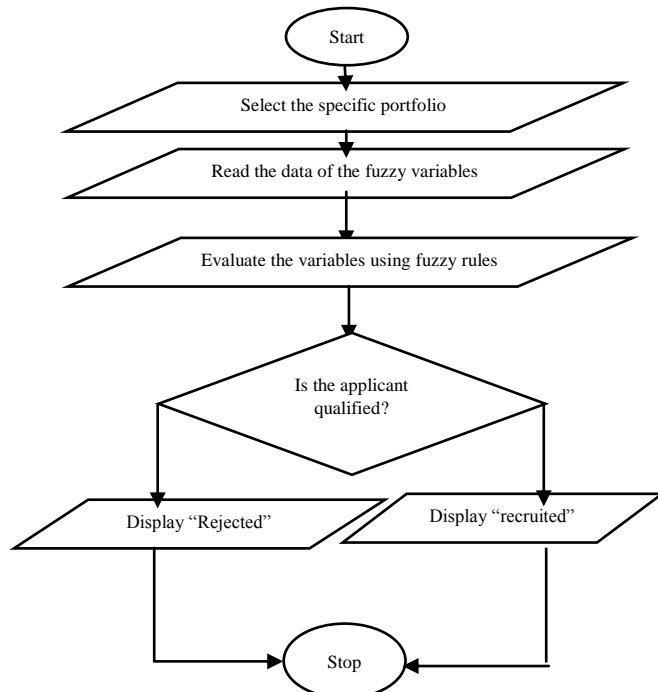
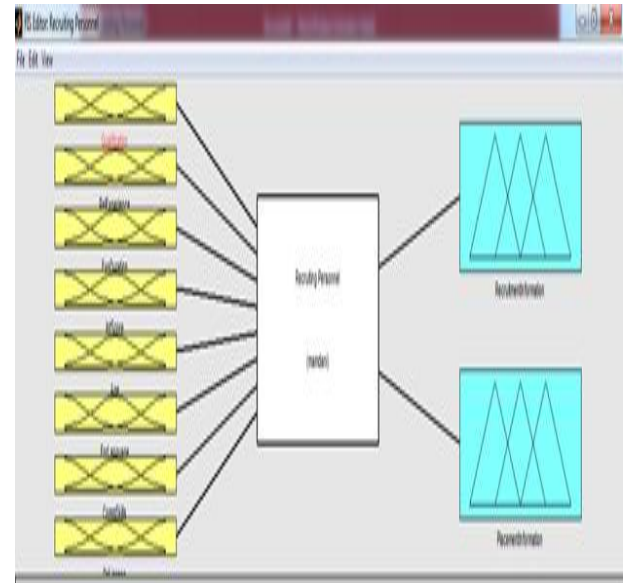


Fig 6: Flowchart of the fuzzy algorithm

### 4.4 Simulation of the Algorithm

The algorithm was simulated using Fuzzy Logic toolbox in MATLAB 7.8.0 (R2009a). The FIS Editor of the Fuzzy Logic Recruitment Expert System of Chief Security portfolio is shown in fig 7



### 4.5 Experimentation and Result

Running test of the designed system was conducted for 4 different portfolio, namely Office Secretary, Dispatch Officer, Motor Mechanic, and Chief Security. Table 1 shows results obtained in Chief Security.

Table 1: Result of the recruitment of Chief security portfolio

Applicant's ID	Mechanic portfolio	
	Result	Intensity (100%)
001-03-02-2014	Rejected	45
002-03-02-2014	Rejected	41
003-03-02-2014	Rejected	48
004-03-02-2014	Rejected	54
005-03-02-2014	Pending	63
006-04-02-2014	Rejected	55
007-04-02-2014	Rejected	49
008-05-02-2014	Pending	67
009-05-02-2014	Rejected	41
010-05-02-2014	Rejected	54
011-05-02-2014	Recruited	89
012-05-02-2014	Rejected	47
013-06-02-2014	Rejected	33
014-06-02-2014	Rejected	51
015-07-02-2014	Rejected	42
016-07-02-2014	Rejected	55

From table 1 above, applicant with ID 0010-05-02-2014 is recruited with intensity mark of 89. 0007-05-02-2014 and 0004-03-02-2014 are asked to be on standby for the office in case 0010-05-02-2014 fails to take up the employment offer. The rest of the applicants are rejected.

### 4.6 Conclusion

Recruitment and placement Fuzzy Logic System was developed and used. Fuzzy logic offer accurate and simplified way of recruiting personnel.

### 4.7 Area for further studies

It will not be possible to use the system for the selection of personnel for different organization because job requirement

specifications are specific or different from organization to another organization.

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