FUZZY LOGIC BASED DECISION SUPPORT SYSTEM FOR SETTING UP NEW SUGAR INDUSTRY IN PUNJAB

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Abstract: Sugar Industry plays a significant role in economic growth of a country. Now a days this industry is facing lot of troubles in India, especially in Punjab. Most of Sugar mills are not functioning properly or near to shut down. So it is very important to make intelligent decision on setting up a sugar industry in a particular area by keeping into consideration factors such as availability of land, labour, raw material, technology, transportation system and power supply. This paper represents a Fuzzy Logic based Decision Support System for setting up sugar industry by taking into account all the above mentioned factors. This system is capable of giving satisfactory and realistic decisions for setting up sugar industry in a particular area so as to avoid wastage of finance, man-power and other natural resources.

Keywords- Sugar Industry, Fuzzy Logic, Decision Support System.

Introduction: Sugar Industry is one of the leading contributors to Indian economy. But in Punjab, this industry is going through difficult times. The reason could be financial or infrastructural; mainly the initial cost required for production of sugarcane is high which farmers cannot afford because of unavailability of a fixed price for sugarcane. Apart from that, lack of skilled labour, technological backlog, electricity problems and lack of direct linkage to transport system are also some of the major factors which are responsible for lesser growth of sugar industry in Punjab [1], [5].

As per as Punjab is concerned, there are 24 sugar mills in the Punjab out of which 16 are in Co-operative sector mills and 8 mills are in private sector. Out of the 16 Co-operative sugar mills, 7 are under liquidation and one private sugar mill has also not operated since 2009-10. Some of the prominent sugar industries of Punjab are Ajnala cooperation sugar mills Ltd., Amritsar, The Doaba cooperation sugar mills LTD, Nawanshahr, Morinda cooperation sugar mills LTD, Roper, Patiala cooperation sugar mills LTD, Patiala, Fazilka cooperation sugar mills, Fazilka etc[4], [5].

Some measures are to be taken to improve the growth of sugarcane crop which could include improvement in planting techniques, manipulation of soil, better irrigation facilities and use of organic fertilizers. Setting up a new venture is a risky task therefore before setting it up all important aspects should be kept in mind.

In this research a fuzzy inference system (FIS) has been designed with help of fuzzy logic for setting up a new sugar industry using MATLAB [2]. The factors used for setting the industry are considered as input parameters for fuzzification. These factors include raw material, labour, land, transport, finance, technology and power supply. The study utilizes FIS to deal with the problem associated with rule explosion. The proposed FIS is implemented using Mamdani-type inference. The output of this fuzzy inference system was a decision about setting up sugar industry which is either SET or NOT SET depending upon all these input factors.

BACKGROUND: Fuzzy logic is being used in wide real- time applications. The idea behind the use of fuzzy logic in making decision about setting up sugar industry is drawn from some prominent implementations of fuzzy logic in certain application areas. In this section, these application areas of fuzzy logic are discussed.

In research paper [6], G.A. Bhosale and R.S. Kamath has discussed about developing a fuzzy inference system (FIS) for teaching staff performance appraisal using MATLAB. By this it can be viewed as an alternative to the use of addition in aggregating the scores from all categories, and to produce a final score which is helpful in making decisions about promotions of teachers.

In paper [7], Liny Lin has discussed the implementation of fuzzy set theory on new product launch decisions for Internet commerce. The strategy for launching new product had significant effect on the success of new product has been given and how to find out key factors of success and failure with the past solutions in business management is a matter of success and failure for enterprise owner.

In paper [8], Geroge and Kyatanavar have given a review on applications of fuzzy logic in sugar industry. This paper reviews the various modeling and control applications in sugar industries using Fuzzy logic. This paper reviews the development of fuzzy logic tools for various applications in sugar industry. The paper also proposes a novel concept of probabilistic fuzzy logic system for modeling and control of various control systems in sugar industry.

After going through these papers, A Fuzzy logic based Decision Support System has been designed for

setting up sugar industry in Punjab.

INTRODUCTION TO FUZZY LOGIC: Dr.LotfiZadeh, a professor of mathematics from U.C. Berkeley, proposed the fuzzy theory 1965 [3].Fuzzy logic is a valuable tool, which can be used to solve highly complex problems where a mathematical model is too difficult. It is also used to reduce the complexity of existing solutions as well as increase the accessibility of control theory. The development of software has always been characterized by parameters that possess certain level of fuzziness [2]. Fuzzy logic controller is rule based controller where a set of rules represents a control decision mechanism to correct the effect of certain cause used for many systems. The configuration of fuzzy logic based system into three parts they are, Fuzzification, Interface Mechanism and Defuzzification. It is implemented in three phases as shown in the following figure[2].

Figure1-Fuzzy Inference System: Different phases

Input Variables	Membership Functions
Raw Material	Poor Quality
	Average Quality
	Good Quality
Land	Not available
	Available
Labour	Not available
	Available
Transportation	Not available
	Available
Finance	Low
	Moderate
	High
Technology	No
	Yes
Power Supply	Not available
	Available

Table 1: Input Variables and their Membership Functions

Fuzzification is the process which converts classical data or crisp data into fuzzy data or Membership Functions (MFs).

Fuzzy Inference Process combines membership functions with the control rules to derive the fuzzy output. *Defuzzification* is the process which use different methods to calculate each associated output and put them into a table.

FUZZY INFERENCE SYSTEM In this research paper, Fuzzy Inference System has been implemented in MATLAB. FIS has five blocks named as FIS editor, membership function editor, rule editor ,rule viewer ,surface viewer [2].

IMPLEMENTATION AND RESULTS

The work which is being presented in this research paper, is implemented in MATLAB 2009b and Windows 7 operating system. A Fuzzy Inference System (FIS) which is named as Sugar Industry, is designed by taking into account seven different input variables and one output variable.

Inputs and output parameters-These are created in FIS editor. In our case we have 7 inputs and single output

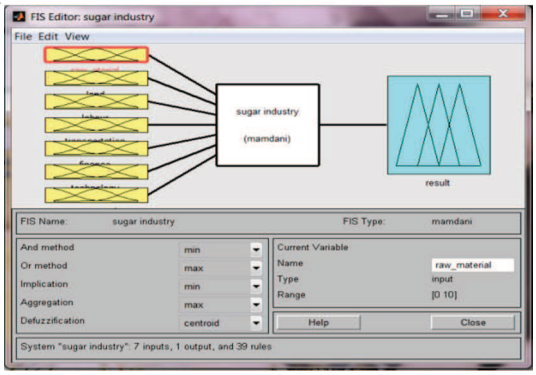


Figure 2-Fuzzy Inference System

In this implementation, triangular membership functions are used to define each input variable range and trapezoidal membership function is used to represent output variable ranges. The other membership function edition specifying membership functions Not Set and Set for output variable Result is shown infigure3. FIS is being designed with the help of fuzzy IF-THEN rules which define a output related to sugar industry output variable Result is set up or not set up depending upon the combination of input variable values as shown in figure3.

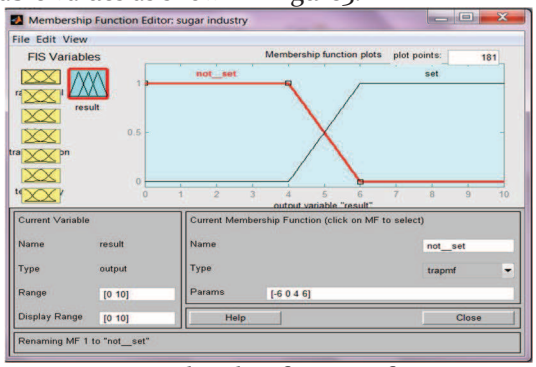


Figure3-membership function for output

While making rules In this implementation, 39 IF-THEN rules are defined by using 7 input variables out of which 5 variables have three membership functions and two variables are fixed to only two discrete levels. Rule Editor and Rule Viewer of Sugar

Industry FIS are shown in following figures.

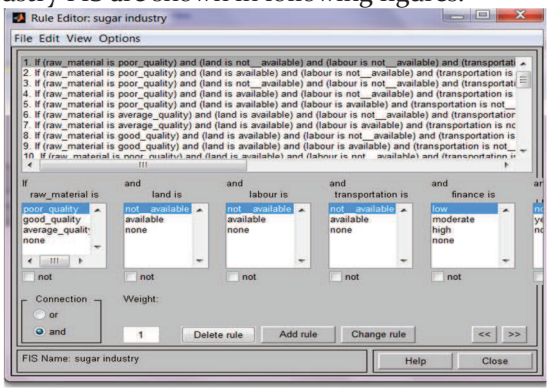
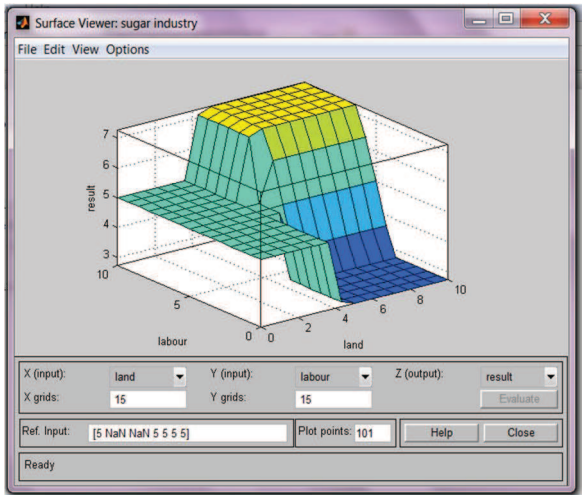


Figure 4- Rule Editor

The Surface Viewer of FIS Sugar industry is demonstrated in following figure which is constructed by taking into consideration two input variables namely land and labour.



Results: After designing of Fuzzy Inference System – Sugar Industry, it was verified by applying number of input combinations whose output was unknown. This FIS gives very satisfactory results. Inputs were varied number of times and every time, output was accordingly varied. The results of this implementation are efficiently matched with practical or realistic outcomes.

In first trail when inputs were rated as 2 1 3 4 1 3 3, the output was 2.8108 and it was recommended not to set sugar industry at that site. In second trail when inputs were 9 7 8 7 6 7 9 the output came out to be 7.3450 and industry could flourish at that site. From these trails results are quite satisfactory and hence Fuzzy logic based Decision Support System is capable of playing an important role in making decision for setting up sugar industry in particular area.

Conclusion : Sugar industry plays a vital role in economic growth of country.Now days, this industry is facing lot of difficulties. Large numbers of factors are responsible for prober functioning of a sugar industry. This paper represents a Fuzzy Logic based Decision Support System about to set up a new sugar industry in any particular area of Punjab. This FIS acts as a solution to qualitative assessment. A large number of factors affecting to set up a new industry are land, labour, raw material, transportation, technology and power supply. This Fuzzy based approach takes into consideration all these factors while making decision in setting up a sugar industry. The results obtained are quite satisfactory and realistic. Hence Fuzzy logic based Decision Support System- Sugar Industry, can play a significant role in making decision for setting up sugar industry in particular area of Punjab or any part of the country so as to avoid wastage of finance, man-power and other natural resources.

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