Determination Of Land Piece Given To Farmers In Land Reform By Using The Fuzzy Logic Method

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INTRODUCTION

Land reform is generally accepted to mean the redistribution of property or rights in land for the benefit of the landless, tenants and farm laborers. The purpose of land reform is to bring about a more equitable distribution of land ownership and access to land. It is the process of examining and changing laws, regulations and customs relating to land ownership and land tenure.

INTRODUCTION

Nowadays, land distribution works are carried out by General Directorate of Agricultural Reform in Turkey. This works are carried out according to 3083 numbered and 22.11.1984 dated law, Agricultural Reform Law for Land Consolidation in Well-Watered Areas, Application Regulations, 4626 numbered and 13,02,2001 dated law Changed Law in Agricultural Reform Law for Land Consolidation in Well-Watered Areas and 18,04,2003 dated law, Technical Instruction for Expropriation, Consolidation, Reallocation.

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This law is for agricultural reform studies and consists of agricultural reform precautions. In this law, it is envisaged that making a landowner of farmers who have not land or sufficient land, expropriation of lands of landowners who have more lands than obtained land norm.

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With using ranking practices according to the instructions of the law, the farmers are being landowners. Watery and dry farmlands are distributed by using the size of watery and dry farmlands, norms of the allocation, the area to be remained to the owner of it and coefficients of transformation. The land is ranked between the intervals of I-VIII. Four degrees are evaluated between each other with coefficients of transformation given in Table 1. The degrees between V-VIII are not subject to the evaluating.

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Table 1. Coefficients of Transformation

Degree of Soil Coefficients of transformation	Lands of degree of III to the other degrees
I	0.707
II	0.816
III	1.000
IV	1.414

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Table 2 shows generally accepted land norm by Council of Ministers in Konya/Turkey

District	Zone of Application	Distribution Norm	
		□rrigated (da)	Arid (da)
Selcuklu	Caldere	45	183
Cumra	Abditolu, Turkmencamili, Üchuyukler	50	154
Eregli	Sazgecit	52	228
Cihanbeyli	Hodoglu	51	177
Altinekin	Oguzeli	51	183
Merkez	Egilmez	64	194
Ayranci	Saraykoy	64	194
Cihanbeyli	Ta□pınar,Gunyuzu	51	177
Karatay	Akorenkisla	45	183
Selcuklu	Karaomerler	45	183
Yunak	Harunlar	49	197
Ilgin			192

INTRODUCTION

Land amounts, which are given landless farmers, have been used by classical method in land distribution study. However, these calculations should be done by using modern methods, because of technological development and science. Fuzzy logic provides one of the most important modern methods that can be used for this purpose.

INTRODUCTION

Fuzzy logic is a recognized instrument for modeling in many scientific and technical fields. There are also a lot of problems where fuzzy methods can be used to reach better solutions than classical models can do. It concerns on the one hand questions, where uncertain parameters occur, which cannot be handled by classical methods in adequate way. On the other hand, there are problems where linguistic fuzzy rules can describe relations better than it can be done by crisp mathematical formulas.

INTRODUCTION

In this study, land amount given to farmers in land reform applications is modeled by the fuzzy logic method. the paper is organized such that in the second part, material and used methods are described and then the fuzzy system is developed and applied for this purpose with relevant conclusions.

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MATERIALS AND METHODS

Distribution norm data for the developed system are taken from the Ilgin District in Turkey. Land Norm of Ilgin District is 192 da. Fuzzy logic method is used for determination of land amounts which are given landless farmers in an application region. For the design process present land amount of farmer (LA), degree of land (LD) and degree of treasury land (land degree which are given farmers) (TD) are used as input parameters and distribution amount (land amount which are given farmers) (DA) as output parameters. The general structure of the fuzzy model is show in Figure 1.

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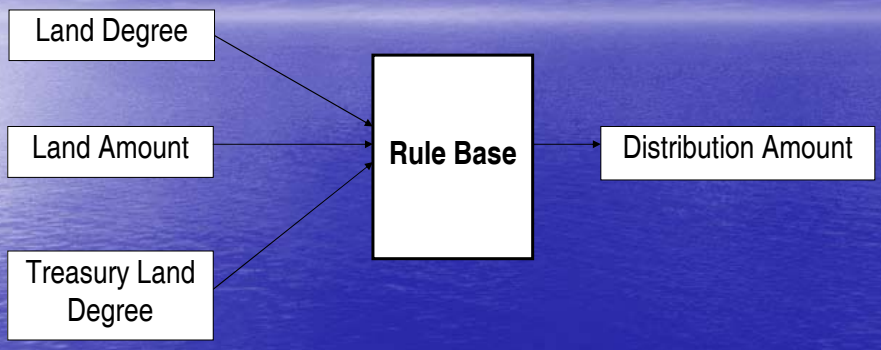

Fig.1. General Structure of Fuzzy Logic Model

Membership Functions

In the established model, different membership functions are formed for land amount of farmer in addition to degrees of land and treasury land, and distribution amount. The form of the membership functions are given in Figures 2, 3, 4 and 5 for each input and output variables. The units of the used factors are: LA (da-decare), LD (unit), TD (unit) and DA (da-decare). LA scale selected as 0-271 da on its membership function. LD membership function is used from 40 to 100 unit scale. DA membership function has a range of 0-271 da scale for distribution amount. TD membership function uses 40-100 unit scale variation domain.

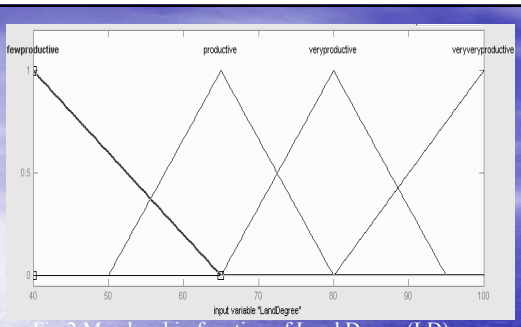

Fig.2.Membership function of Land Degree(LD)

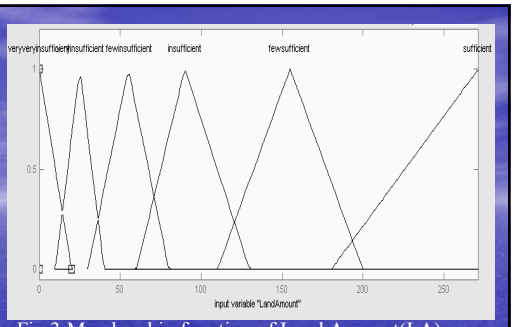

Fig.3.Membership function of Land Amount(LA)

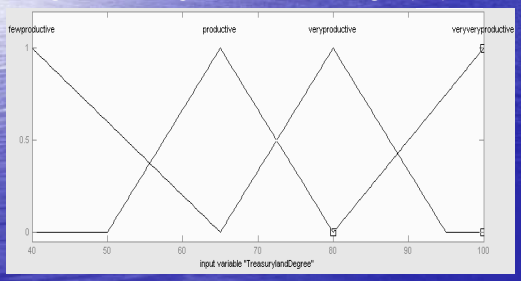

Fig.4. Membership function of Treasury Land Degree

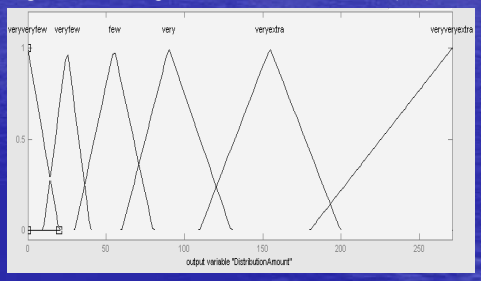

Fig.5. Membership function of distribution amount

From the developed rules, for example, for LD linguistic expressions as follows:

$\mu fewproductive(A) = \begin{cases} \frac{65-a}{65}; 0 < a < 65 \\ 0; othercases \end{cases}$

$\mu productive(A) = \begin{cases} 0; & a \le 50 \\ \frac{a-50}{15}; & 50 < a \le 65 \\ \frac{80-a}{15}; & 65 < a < 80 \\ 0; & a \ge 80 \end{cases}$

$\mu veryproductive(A) = \begin{cases} 0; & a \le 65 \\ \frac{a-65}{15}; & 65 < a \le 80 \\ \frac{95-a}{15}; & 80 < a < 95 \\ 0; & a \ge 95 \end{cases}$

$\mu veryveryproductive(A) = \begin{cases} \frac{a-80}{20}; 80 < a \le 100 \\ 0; \quad othercases \end{cases}$

Rule Base

A convenient rule base is necessary to run the fuzzy model. Although in total 96 rules are formed, but parts of the developed fuzzy rules are shown in the Table 3. It is important that the rules are not completely written for all possibility cases, because implausible ones are not considered at all. Figures 6 and 7 present relationships between input, land amount of farmer, degree of land, and distribution amounts.

Rule No	*LD*	*LA*	*TD*	**DA**
Rule1	fewproductive	veryveryinsufficient	fewproductive	veryveryextra
Rule2	fewproductive	veryveryinsufficient	productive	veryveryextra
Rule3	fewproductive	veryveryinsufficient	veryproductive	veryextra
…….				
Rule21	productive	veryveryinsufficient	fewproductive	veryveryextra
Rule22	productive	veryveryinsufficient	productive	veryextra
Rule23	productive	veryveryinsufficient	veryproductive	veryextra
……				
Rule41	veryproductive	veryveryinsufficient	fewproductive	veryveryextra
Rule42	veryproductive	veryveryinsufficient	productive	veryextra
Rule43	veryproductive	veryveryinsufficient	veryproductive	veryextra
……				
Rule61	veryveryproductive	veryveryinsufficient	fewproductive	veryveryextra
Rule62	veryveryproductive	veryveryinsufficient	productive	veryextra
Rule63	veryveryproductive	veryveryinsufficient	veryproductive	veryextra
……..				

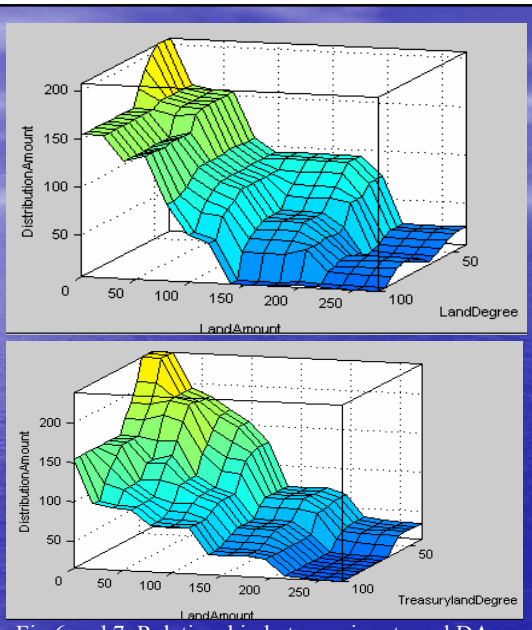

Fig.6 and 7. Relationship between inputs and DA

Defuzzification

At this stage, truth degrees (α) of the rules are determined for the each rule by aid of the min. and then by taking max. between working rules. For example, for LD=80 unit, LA=73 da, TD=80 unit, the rules 51 and 91 will be fired with the following results:

α51 = min(productive LD, veryinsufficient LA, veryproductive TD) = min(1, 0.43, 1) = 0.43.

α91 = min(productive LD, insufficient LA, veryproductive TD) = min(1, 0.28, 1) = 0.28.

Defuzzification

From Mamdani max-min inference it is possible to obtain the membership function of the constructed system as max(α51, α91)=0.43, which means Very DA. Consequently, one can calculate the crisp output. For instance, the crisp value of the DA is calculated by the method centroid defuzzifier by the following formula as,

$$z^* = \frac{\int u_c(z).z dz}{\int u_c(z) dz}$$

As also seen from the Fig. 8, the value of DA= 94. This means that the land amount, which is given to farmers (distribution amount) is 94.

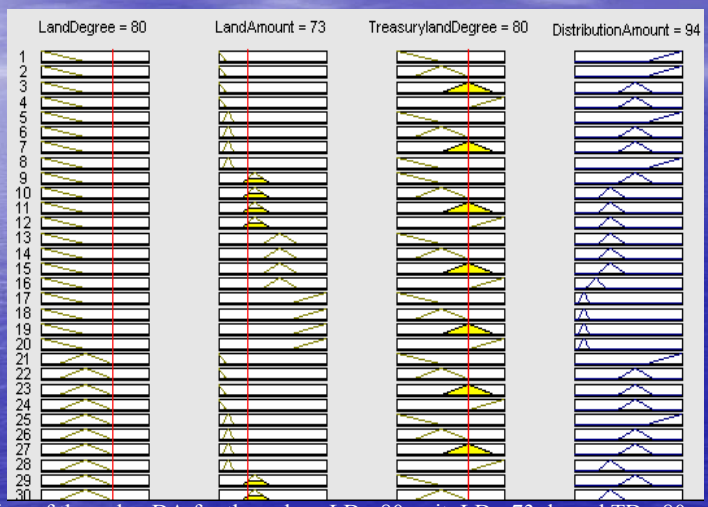

Fig.8. Calculation of the value DA for the values LD= 80 unit, LD= 73 da and TD= 80 unit.

DISCUSSION AND CONCLUSION

The methodology developed in this paper is applied the first time to land amount distribution to farmers with fuzzy logic and system approach. The results of the developed Fuzzy Logic Model (FLM) are compared with the results of the traditional methodology as shown in Table 4. It is possible to conclude from this table that the finding land amount given to farmers by FLM abides closely with the data, which is the traditional way of distribution of the land amount.

Table 4. Comparison of the FES and Traditional Method

LD	*LA*	*TD*	*Traditional Method*	Fuzzy Logic Method
60	10	60	182	179
60	20	60	178	177
90	50	90	86	94
80	70	80	87	94
80	20	60	167	177
-	0	80	157	155
42	100	90	86	94
90	30	70	150	155
50	100	80	99	94
80	50	70	131	135
70	80	80	91	94
45	100	80	99	94

DISCUSSION AND CONCLUSION

For this purpose the linguistic variables are considered as six fuzzy sets. If one selects more fuzzy sets for the linguistic variables, then the results can be closer to the traditional values, hence a very suitable model is obtained for land amount distribution to the farmers. The study also shows that LA is an important factor in finding land amount, and few LA cause increase in the DA. This system is rapid, equitable and correct than traditional methods, has also a high reliability. In additional to that its accuracy is controlled by line with 45^0 as the plot of fuzzy system solution versus the traditional data values as shown in Figure 9.

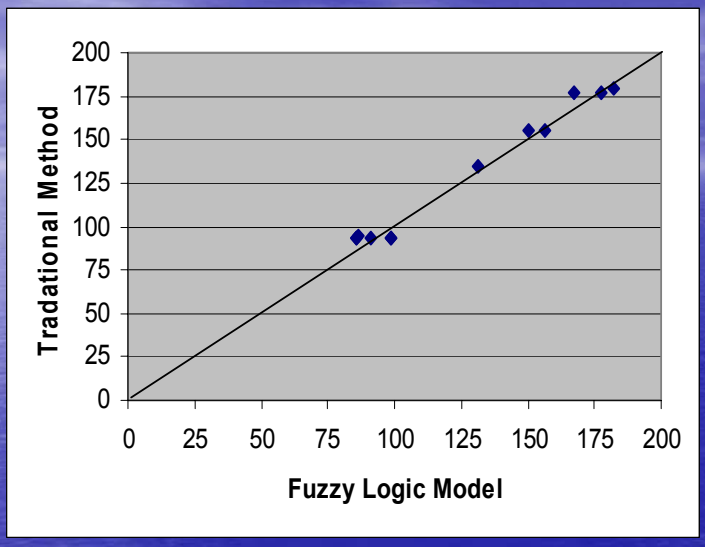

Fig.9. Accuracy of Fuzzy Logic Model by Line with 450

DISCUSSION AND CONCLUSION

This paper describes a design of fuzzy system model for determination of land amount given to farmers, which can be used easily by operator of land reform. This system can be developed further with increasing the knowledge rules from one side and with the increase in the number of linguistic variables on the other side.

THANK YOU FOR ATTENTION

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