

Gradation of NGO's Role in Rural Development: A Fuzzy Soft Set Theoretic Approach

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Abstract— The non-governmental organizations (NGO) are recognized as important institutional actors that are expected to facilitate the participation of beneficiaries in the development programmes such as mobilising community assets, motivating people, implementing social welfare programmes for the deprived one regarding their education, social status, health awareness, economic development etc. The flexibility of structures, involvement of beneficiaries and commitment of functionaries are critical to the effectiveness of NGOs. This article aims to find out rational and logical solutions about the involvement of NGOs in certain rural development activities. With the help of fuzzy soft sets, in our article, an attempt has been made to grade NGO's role on the basis of their strategies and functions.

Keywords— Soft Set, Fuzzy Soft Set, Decision Making, NGO.

I. INTRODUCTION

Most of the concepts we meet in our day to day life are not precise. Mathematical modeling of such day to day problems involving uncertainties is of great importance now a days. There are theories e.g. Probability Theory, Fuzzy Set Theory, Intuitionistic Fuzzy Set Theory, Rough Set Theory etc. to deal with problems involving uncertainties. However these theories are found to be inadequate in recent times. Infact, the inadequacy of the parameterization tool in these theories do not allow them to handle vagueness properly. In 1999 Molodtsov [3] introduced the concept of Soft Sets and established the fundamental results of the new theory. Soft Set Theory is free from the difficulties present in Fuzzy Set Theory, Rough Set Theory, Probability Theory etc. In 2001, Maji [6] studied the theory of soft sets and initiated some new results. Neog and Sut [7] further redefined complement of a soft set and showed that the axioms of exclusion and contradiction are satisfied by the soft sets also.

In recent times, fuzzification of Soft Set Theory is developing rapidly. Combining fuzzy sets and soft sets, Maji et al. [5] put forward a new model known as fuzzy soft set. He introduced some properties regarding fuzzy soft union, intersection, complement of a fuzzy soft set, De Morgan Law etc. Ahmad and Kharal [2] further revised and improved these results.

Now a days, application of Fuzzy Soft Set Theory in many

disciplines and real life situations have been studied by many researchers. The Indian Society is basically rural in character where two third of the population lives in villages and majority of them depends on agriculture which constitutes the Indian Economy. The government of India, during the last five and half decade initiated a number of programmes to meet the basic needs of the rural people and to eliminate poverty. Since the first five year plan in 1951, planning is considered as one of the important tool for the development of the nation through people's participation in Community Development Programmes and National Extension Service Programmes. However, anomaly of this scheme was pointed out later by the Balwantrai Mehta Committee and accordingly Panchayati Raj System was introduced in 1959 with high hope [4]. However, without giving it fair trial, from the late sixties, government adopted a new strategy of development popularly known as Green Revolution. By late 1960's, it was recognized that the benefits of such growth were not ultimately reaching the target group and it has in turn widened the gap between the rich and the poor. The government has initiated several special programmes during various five year programmes to ensure economic development in the rural area by means of people's participation and also has tried to encourage Self Help Groups as well as NGO s for implementation of the programmes rather than government organizations. Our work is an endeavour to develop a mathematical model using the theory of fuzzy soft sets in the gradation of NGO s depending on their role in rural development.

II. PRELIMINARIES

A. Definition 1 [3]

A pair (F, E) is called a soft set (over U) if and only if F is a mapping of E into the set of all subsets of the set U .

In other words, the soft set is a parameterized family of subsets of the set U . Every set $F(\varepsilon), \varepsilon \in E$, from this family may be considered as the set of ε - elements of the soft set (F, E) , or as the set of ε - approximate elements of the soft set.

B. Definition 2 [5]

A pair (F, A) is called a fuzzy soft set over U where $F : A \rightarrow \tilde{P}(U)$ is a mapping from A into $\tilde{P}(U)$.

C. Definition 3 [2]

Let U be a universe and E a set of attributes. Then the pair (U, E) denotes the collection of all fuzzy soft sets on U with attributes from E and is called a fuzzy soft class.

D. Definition 4 [5]

For two fuzzy soft sets (F, A) and (G, B) in a fuzzy soft class (U, E) , we say that (F, A) is a fuzzy soft subset of (G, B) , if

- (i) $A \subseteq B$,
- (ii) For all $\varepsilon \in A$, $F(\varepsilon) \subseteq G(\varepsilon)$ and is written as $(F, A) \subseteq (G, B)$.

E. Definition 5 [5]

Union of two fuzzy soft sets (F, A) and (G, B) in a soft class (U, E) is a fuzzy soft set (H, C) where $C = A \cup B$ and $\forall \varepsilon \in C$,

$$H(\varepsilon) = \begin{cases} F(\varepsilon), & \text{if } \varepsilon \in A - B \\ G(\varepsilon), & \text{if } \varepsilon \in B - A \\ F(\varepsilon) \cup G(\varepsilon), & \text{if } \varepsilon \in A \cap B \end{cases}$$

and is written as $(F, A) \cup (G, B) = (H, C)$.

F. Definition 6 [5]

Intersection of two fuzzy soft sets (F, A) and (G, B) in a soft class (U, E) is a fuzzy soft set (H, C) where $C = A \cap B$ and $\forall \varepsilon \in C$, $H(\varepsilon) = F(\varepsilon) \cap G(\varepsilon)$ (as both are same fuzzy set) and is written as $(F, A) \cap (G, B) = (H, C)$.

Ahmad and Kharal [2] pointed out that generally $F(\varepsilon)$ or $G(\varepsilon)$ may not be identical. Moreover in order to avoid the degenerate case, he proposed that $A \cap B$ must be non-empty and thus revised the above definition as follows:

G. Definition 7 [2]

Let (F, A) and (G, B) be two fuzzy soft sets in a soft class (U, E) with $A \cap B \neq \emptyset$. Then Intersection of two fuzzy soft sets (F, A) and (G, B) in a soft class (U, E) is a fuzzy soft set (H, C) where $C = A \cap B$ and $\forall \varepsilon \in C$, $H(\varepsilon) = F(\varepsilon) \cap G(\varepsilon)$. We write $(F, A) \cap (G, B) = (H, C)$.

H. Definition 8 [1]

If (F, A) and (G, B) are two fuzzy soft sets then the fuzzy soft subset (R, C) of $(F, A) \times (G, B)$ is called a fuzzy soft relation. Here, $C \subset A \times B$ and $\forall (x, y) \in A \times B$, $R(x, y)$ is a fuzzy subset of $P(x, y)$ where, $P(x, y) = F(x) \cap G(y)$.

I. Definition 9 [1]

The fuzzy soft set (R, C) of (F, A) is called an n -ary fuzzy soft relation. Here, $C \subset A_1 \times \dots \times A_n$ $\forall (x_1, \dots, x_n) \in A_1 \times \dots \times A_n$, $R(x_1, \dots, x_n) \subset O$ where, $O(x_1, \dots, x_n) = F_1(x_1) \cap \dots \cap F_n(x_n)$.

By analogy the relation on n -soft sets is called an n -ary or n -dimensional relation.

III. APPLICATION OF FUZZY SOFT SETS IN GRADING NGO'S ROLE IN RURAL DEVELOPMENT

NGOs have the potential to mobilize and liberalize the local resources for development. Therefore NGO's role has become the key factor in development and hence arguments for and against the ability of NGOs to raise the confidence and competence of people through their activities has become a matter of serious debate. Development cannot be sustainable and long lasting unless people's participation is made certain to the development process. The nature of unresponsiveness of the government agencies has encouraged the people to organize themselves through NGOs. In this work, an attempt has been made to study the beneficiary's perception of NGOs in the development process in different fields such as economic, education, health, political and social awareness. Accordingly data were collected by means of convenient sampling technique from among one hundred beneficiaries on participation in Jorhat Sub-Division, Assam, India. It was found that total impression on decision regarding grading NGOs role is influenced by the following operation fields.

$$T_1 = \text{Economic Development}$$

It refers to the growth and assurance of protection of funds invested under changing condition.

$$T_2 = \text{Educational Achievement}$$

Spread of education also overcomes the traditional inequality and contributes for economic development.

$$T_3 = \text{Health Awareness}$$

It refers to the consistent improvement of medical sector for minimizing health problems.

$$T_4 = \text{Political Awareness}$$

It refers to the consciousness of the citizens about plan and policy and also strategy of the government towards them.

$$T_5 = \text{Social Awareness}$$

It refers to social accountability involved in public oriented development activities.

Following are some NGOs which are mostly preferred by the respondents.

$$U_1 = I - Card$$

$$U_2 = Needs$$

$$U_3 = Malow Pather$$

$$U_4 = Purba Bharati$$

$$U_5 = Hope Line$$

We consider the set $U = \{U_1, U_2, U_3, U_4, U_5\}$ as our universal set and the set $E = \{T_1, T_2, T_3, T_4, T_5\}$ as the set of parameters. We construct the fuzzy soft sets $(F_1, T_1), (F_2, T_2), (F_3, T_3), (F_4, T_4)$ and (F_5, T_5) , where

$$\mu_{F_i(T_i)}(U_j)$$

$$= \frac{\text{No. of respondents stating the presence of } U_j \text{ in } T_i}{\text{Total No. of respondents}}$$

Thus we have the following fuzzy soft sets-

(F_1, T_1)

$$= \{F_1(T_1) = \{(U_1, 0.9), (U_2, 0.8), (U_3, 0.6), (U_4, 0.3), (U_5, 0.2)\}\}$$

(F_2, T_2)

$$= \{F_2(T_2) = \{(U_1, 0.8), (U_2, 0.7), (U_3, 0.1), (U_4, 0.3), (U_5, 0.8)\}\}$$

(F_3, T_3)

$$= \{F_3(T_3) = \{(U_1, 0.4), (U_2, 0.9), (U_3, 0.2), (U_4, 0.6), (U_5, 0.5)\}\}$$

(F_4, T_4)

$$= \{F_4(T_4) = \{(U_1, 0.2), (U_2, 0.5), (U_3, 0.2), (U_4, 0.8), (U_5, 0.4)\}\}$$

(F_5, T_5)

$$= \{F_5(T_5) = \{(U_1, 0.9), (U_2, 0.9), (U_3, 0.4), (U_4, 0.8), (U_5, 0.7)\}\}$$

We construct the fuzzy soft relation (R, C) of (F_i, T_i) , where we take

$R(T_1, T_2, T_3, T_4, T_5)$

$$= F_1(T_1) \cap F_2(T_2) \cap F_3(T_3) \cap F_4(T_4) \cap F_5(T_5)$$

$$= \{(U_1, 0.2), (U_2, 0.5), (U_3, 0.1), (U_4, 0.3), (U_5, 0.2)\}$$

It follows that U_2 i.e. *Neads* has got the largest membership value (0.5) and *Malow Pather* has the smallest membership value (0.1) and consequently we have the following gradation in descending order of their performances –

1. U_2 : Neads
2. U_4 : Purba Bharati
3. U_1 : I Card and U_5 : Hope Line
4. U_3 : Malow Pather

IV. CONCLUSIONS

Now a day, fuzzy modeling has been applied in a wide variety of fields such as engineering, management sciences and social sciences to solve various problems which involve impreciseness, uncertainty and vagueness in data. The concept of fuzzy soft sets can be used in developing models for such problems in order to get decisions that are closest to the desired objective. It is hoped that our work would enrich this study in modeling real life problems involving uncertainties.

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