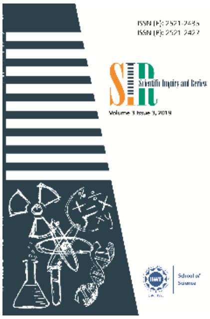

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Decision-Making in Mass Media Using Fuzzy Soft Sets

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Abstract

Mass media is the third largest emerging industry in Pakistan. It involves decision-making with regard to the selection of shows, anchors, lighting and technical equipment. The problem becomes acute as most channel owners are investors and seldom know about the complications and technicalities of this industry. Solutions given by fuzzy structures in different areas induced us to find their application in the nexus of mass media. In this paper, the choice matrices and cardinals of the fuzzy soft set are utilized for decision-making. A case study is discussed which involves the ordering of TV shows to be aired daywise in a sequence using choice matrix and reduct fuzzy soft set. An application along with an algorithm is provided for the selection of anchor person for any TV program on the basis of cardinal sets and FS-aggregation operator.

Keywords: fuzzy soft set, FS-aggregate algorithm, selection

Introduction

The tool of fuzzy sets for dealing with uncertainties was founded by Zadeh in 1965 [1]. A fuzzy set is a bijection from the choice function to the interval [1]. Rough set was developed by Pawlak in 1982, which was later applied in the nexus of medical science, computer systems and in modeling other fields [2]. At present, the soft set theory is progressing rapidly by creating advancements in all fields of science and social sciences [3]. The applications of soft set theory in decision-making can be found in [4], whereas a new definition of parameterizations' reduction can be seen in [5] which can be used to reduce and compare attributes' reduction in a rough set structure. The algebra of soft set was introduced by Rosenfeld [6]. Biswas et al. discussed the algebraic nature of rough sets and proposed the topic of rough groups [7]. Saeed et al. came up with the new notion of soft element and soft members under the soft set environment [8].

The concept of fuzzy soft set (fs-set) was given by Maji et al. through the amalgamation of the ideas of fuzzy sets in [9]. A number of researchers have harnessed fs-sets to propose the solutions of problems requiring decision-making, which can be seen in [10, 11]. Moreover, Bhardwaj et al. used reduct soft set for real life decision-making problems [12]. Lin presented the novel theory of soft set for computing a unified view of fuzzy sets via neighborhood and applied it in the selection of decision-making problems [13, 14]. Zulqarnain et al. presented the generalized TOPSIS technique for multi-criteria decision-making in a neutrosophic structure and in an intuitionistic fuzzy soft structure to diagnose a medical disease in [15, 16]. Saeed et al. described the major applications of fuzzy logic controller in smart parking system and the impact of pH on detergent in automatic washing machine in [17, 18]. Rahman et al. introduced the m-convex and m-concave sets in the structure of soft sets and their properties [19]. Saeed et al. described the wide application of neutrosophic soft set in player selection for soccer team and extended the use of TOPSIS technique in intuitionistic fuzzy structure based on linguistic terms for decision-making in [20, 21].

In this paper, we devise the techniques discussed by Pal in [14] and Gogai et al. [22] to solve decision-making problems encountered by media houses in a rather different way. The paper has the following formation. Section 1 of this note comprises introduction, section 2 presents some fuzzy soft set theoretic definitions, section 3 presents algorithms designed to help us solve the problems discussed in this paper, section 4 presents the problems discussed in this paper and at the end in section 5, conclusion and future directions are presented.

2. Preliminaries

In this section, we state some basic notions related to the current article.

2.1. Fuzzy Set

Fuzzy set A in universe Y is as follows:

$$A = \{(y, \mu_A(y)): y \in Y\}$$

where the function $\mu_A: Y \to [1]$ defines the degree value of the membership of the element $y \in Y$ [1].

Let A and B be two fuzzy sets and μ_A, μ_B are their membership functions. The complement A' is defined by its membership bijection as

$$\mu_{A'}(y) = 1 - \mu_A(y); \text{ for } y \in Y$$

The union operation $A \cup B$ of union can be expressed as

$$\mu_{A \cup B}(y) = max\{\mu_A(y), \mu_B(y)\}$$

The intersection operation $A \cap B$ of union can be expressed as

$$\mu_{A \cap B}(y) = min\{\mu_A(y), \mu_B(y)\}$$

2.2. Soft Set

Molodtsov rectified this difficulty by using appropriate parameterization. Let Λ be any nexus and Ω be a set of parameters. The pair (F, Ω) is called a soft set (over Λ), if and only if F is a mapping of Ω onto the set of all subsets of Λ. Hence, soft set is a parameterized family of the subsets of the set Λ.

In this paper, Λ is any nexus, Ω is a set of parameters, $P(\Lambda)$ is the power set of Λ, and $B \subseteq \Omega$.

A soft set (F, B) over Λ is a set defined by a bijection F_B representing a mapping $F_B: B \to P(\Lambda)$ for all $\omega \in B$. The soft set (F, B) can be depicted by the collection of ordered order pairs [3].

$$(F, B) = \{(\omega, F_B(\omega)): \omega \in B, F_B(\omega) \in P(\Lambda)\}$$

Example

Suppose $\Lambda = \{\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5\}$ be a universal set and $\Omega = \{\omega_1, \omega_2, \omega_3, \omega_4\}$ be a set of parameters. If $B = \{\omega_1, \omega_2, \omega_4\} \subseteq \Omega$, $F_B(\omega_1) = \{\lambda_2, \lambda_4\}, F_B(\omega_2) = \Lambda$ and

$F_B(\omega_4) = \{\lambda_1, \lambda_3, \lambda_5\}$, then the soft set F_B is written as

$$F_B = \{(\omega_1, \{\lambda_2, \lambda_4\}), (\omega_2, \Lambda), (\omega_4, \{\lambda_1, \lambda_3, \lambda_5\})\}$$

2.3. Fuzzy Soft Set

A fuzzy soft set (F, B) over Λ is a set given by the bijection F_B representing the mapping $F_B: B \rightarrow P^F(\Lambda)$. Here, F_B is called fuzzy approximate function of the fuzzy soft set (F, B). Thus, a fuzzy soft set (F, B) over Λ can be represented by the set of ordered pairs in the following way [9]

$$(F, B) = \{(\omega, F_B(\omega)): \omega \in \Omega; F_B(\omega) \in P^F(\Lambda)\}$$

Note that the set of all fuzzy subsets over Λ will be denoted by $P^F(\Lambda)$.

Let $(F, B) \in FS(\Lambda)$. If $F_B(\omega) = \phi$; for all $\omega \in B$, then (F, B) is known as an empty fuzzy soft set depicted by F_ϕ.

Let $(F, B) \in FS(\Lambda)$. If $F_B(\omega) = \Lambda$ for all $\omega \in B$, then (F, B) is known as a universal fuzzy soft set depicted by F_Λ.

Example

Let $\Lambda = \{\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5\}$ be a universal set and $\Omega = \{\omega_1, \omega_2, \omega_3, \omega_4\}$ be a set of parameters. If $B = \{\omega_1, \omega_2, \omega_4\} \subseteq \Omega, F_B(\omega_1) = \{0.9/\lambda_2, 0.5/\lambda_4\}, F_B(\omega_2) = \Lambda$, and

$F_B(\omega_4) = \{0.2/\lambda_1, 0.4/\lambda_3, 0.8/\lambda_5\}$, then the soft set F_B is writtenas

$$(F, B) = \{(\omega_1, \{0.9/\lambda_2, 0.5/\lambda_4\}), (\omega_2, \Lambda), (\omega_4, \{0.2/\lambda_1, 0.4/\lambda_3, 0.8/\lambda_5\})\}.$$

2.4. Reduct Soft Set

Let $C \subseteq \Omega$ and $(F, C) \subseteq (F, \Omega)$. Suppose R is a reduct of C. Then, the soft set (F, R) is called a reduct softest (F, C). The choice value of an object $C_i\Lambda$ is $p_{i,}$ where $p_i = \sum c_{ij}$ and c_{ij} are the entries in the table of the reduct softset [5].

2.5. Weighted Soft Set

The weighted soft set called "W-soft set" comprises the weights given to the attributes of each choice of the objects under consideration, that is, for

$c_i \in \lambda$ this value is $W_{pi,}$ where $W_{pi} = \sum d_{ij}$ such that $d_{ij} = w_j \times y_{ij}$ [5].

3. Fuzzy Soft Aggregation Operator

A fuzzy soft (fs) aggregation operator is a tool used for generating an aggregate out of fs-set and its cardinal set of a fuzzy set. The approximate functions of an fs-set are fuzzy in nature. An fs-aggregation operator is an operator which joins together a number of approximate functions of an fs-set to form a single aggregate of fs-set, such that the resulting set is fuzzy in nature. After calculating an aggregate fuzzy set, it becomes necessary to identify the best single option out of the resulting ones. Therefore, we can do decision-making via the algorithm given below.

Step 1: Compute (F, B) over Λ
Step 2. Calculate cardinal set (c-set) $c(F, B)$ of (F, B)
Step 3: Evaluate aggregate fuzzy set $(F, B)^*$ of (F, B)
Step 4: Identify the best option from the resulting set by finding max $(F, B)^*(\lambda)$

Step 1

Let $(F, B) \in FS(\Lambda)$. Assume that $\Lambda = \{\lambda_1, \lambda_2, \dots, \lambda_m\}$, $\Omega = \{\omega_1, \omega_2, \dots, \omega_n\}$ and $B \subseteq \Omega$, then (F, B) can be presented as shown in Table 1.

Table 1. Tabular Representation of Fuzzy Soft Set (F, B)

$(\boldsymbol{F}, \boldsymbol{B})$	$\boldsymbol{\omega_1}$	$\boldsymbol{\omega_2}$	$\vdots$	$\boldsymbol{\omega_n}$
λ_1	$\mu_{F_B}(\omega_1)(\lambda_1)$	$\mu_{F_B}(\omega_2)(\lambda_1)$	$\vdots$	$\mu_{F_B}(\omega_n)(\lambda_1)$
λ_1	$\mu_{F_B}(\omega_1)(\lambda_2)$	$\mu_{F_B}(\omega_2)(\lambda_2)$	$\vdots$	$\mu_{F_B}(\omega_n)(\lambda_2)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
λ_m	$\mu_{F_B}(\omega_1)(\lambda_m)$	$\mu_{F_B}(\omega_2)(\lambda_m)$	$\vdots$	$\mu_{F_B}(\omega_n)(\lambda_m)$

Where $\mu_{F_B}(\omega)$ is the membership function of (F, B). If $b_{ij} = \mu_{F_B}(\omega_j)(\lambda_i)$ for $i = 1,2, \dots, m$ and $j = 1,2, \dots, n$; then (F, B) is distinctly expressed by the following matrix:

$$[a_{ij}] = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ b_{m1} & b_{m2} & \dots & b_{mn} \end{bmatrix}$$

This matrix is called an $m \times n$ fs-matrix of (F, B) over Λ.

Step 2

Let $(F, B) \in FS(\Lambda)$, then the cardinal set (c-set) of (F, B) denoted by $c(F, B)$ and defined by $c(F, B) = \{\mu_{c(F_B)}(\omega)/\omega : \omega \in B\}$ is a fuzzy set over Ω. The membership function $\mu_{c(F_B)}$ of $c(F, B)$ is defined by $\mu_{c(F_B)}: \Omega \to [0,1]$

$$\mu_{c(F_B)}(\omega) = \frac{|F_B(\omega)|}{|\Lambda|}.$$

where $|\Lambda|$ and $|F_B(\omega)|$ are the cardinalities of nexus Λ and fuzzy set $F_B(y)$, respectively. The collection of all c-sets of the fs-sets over U are depicted by $cFS(\Lambda) \subseteq F(\Lambda)$. Let $(F, B) \in FS(\Lambda)$ and $c(F, B) \in cFS(\Lambda)$.

Assume that $\Omega = \{\omega_1, \omega_2, \dots, \omega_n\}$ and $B \subseteq \Omega$, then $c(F, B)$ can be presented by Table 2.

Table 2. Representation Cardinal Set (c-set) of (F, B)

$\boldsymbol{c(F, B)}$	$\boldsymbol{\omega_1}$	$\boldsymbol{\omega_2}$	$\vdots$	$\boldsymbol{\omega_n}$
$\mu_{c(F_B)}$	$\mu_{c(F_B)}(\omega_1)$	$\mu_{c(F_B)}(\omega_2)$	$\vdots$	$\mu_{c(F_B)}(\omega_n)$

If $a_{1j} = \mu_{c(F_B)}(\omega_j)$ for $j = 1,2, \dots, n$, then the c-set $c(F, B)$ is distinctly expressed by the matrix,

$$[a_{1j}] = [a_{11}, a_{12}, \dots, a_{1n}]$$

which is called the cardinal matrix (c-matrix) of the c-set $c(F, B)$ over Λ.

Step 3

Let $(F, B) \in FS(\Lambda)$ and $c(F, B) \in cFS(\Lambda)$, then the fs-aggregation operator denoted by FS-agg is defined by $FS - agg: cFS(\Lambda) \times FS(\Lambda) \to F(\Lambda)$ as

$$FS - agg(c(F,B),(F,B)) = F * B$$

where $F * B = \{\mu_{F*B}(\lambda)/\lambda : \lambda \in \Lambda\}$ is a fuzzy set over U. $F * B$ is called the aggregate fuzzy set of the fs-set (F,B). The membership function μ_{F*B} of $F * B$ is as follows:

$$\mu_{F*B} : \Lambda \rightarrow [0,1]$$

$$\mu_{F*B}(u) = \frac{1}{|\Lambda|} \sum_{\omega \in \Omega} \mu_{c(F_B)}(\lambda)(\omega) * \mu_{F_B}(\lambda)(\omega)$$

where $|\Lambda|$ is the cardinality of Λ.

Let $(F,B) \in FS(\Lambda)$ and $c(F,B) \in cFS(\Lambda)$. $(F * B)$ are presented in Table 3.

Table 3. Representation of $F * B$

$\boldsymbol{F * B}$	$\boldsymbol{\mu_{F*B}}$
λ_1	$\mu_{F*B}(\lambda_1)$
λ_2	$\mu_{F*B}(\lambda_2)$
λ_3	$\mu_{F*B}(\lambda_2)$
.	.
.	.
.	.
λ_m	$\mu_{F*B}(\lambda_m)$

If $c_{i1} = \mu_{F*B}(\lambda_i) fori = 1,2,\dots,m$ then $F * B$ can be represented by the following matrix $[c_{i1}]$:

$$[c_{i1}] = \begin{bmatrix} c_{11} \\ c_{21} \\ \vdots \\ c_{m1} \end{bmatrix}$$

It is known as the aggregate matrix of $F * B$ over Λ. Suppose $M \circ (F,B)$, $M \circ c(F,B)$, $M \circ F * B$ denote the matrices of (F,B), $c(F,B)$ and $F * B$ respectively, then

$$|\Lambda| \times M \circ F * B = M \circ (F,B) \times M^t \circ c(F,B),$$

and

$$M \circ F * B = \frac{1}{|\Lambda|} M \circ (F, B) \times M^t \circ c(F, B).$$

where $M^t \circ c(F, B)$ is the transpose of $M \circ c(F, B)$ and $|\Lambda|$ is the cardinality of Ω.

Step 4

Lastly, we find the best possible choice by finding the maximum value of the aggregate matrix $F * B$.

4. Main Result

Two sets of problems encountered by media houses. First is to choose a day for the show to be telecasted and the second is the selection of an anchor person for a particular time slot. The former is solved using fs-agg algorithm.

4.1. Case Study 1

Seven shows are available to be aired at the peak hour, seven days a week. The question is that depending on commercials rate, channel rating and demand, the management of the TV channel has to decide on which day which program should be aired? According to the data given by the marketing department of the TV channel, depending on commercials rate, therating at prime time is higher on Sunday, whereas the rest of the five days in descending order are as follows: Saturday, Friday, Thursday, Monday and Wednesday. On which day which particular show should be aired at prime time?

The management of the TV channel has the following set of programs

$$\Lambda = \{\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5, \lambda_6, \lambda_7\}$$

with the following sets of attributes

$$\Omega = \{\omega_1 = \text{ Star Cast}, \ \omega_2 = \text{ Writer}, \ \omega_3 = \text{ International Value}$$
$$\omega_4 = \text{ Target Audience}, \ \omega_5 = \text{ Adaptation}\}$$

4.1.1. Parameters

Here, we explain all the attributes turn by turn.

Star Cast

Star cast refers to the attributes of actors, whether they are famous, debutante or average stars? For example, the star cast of a show comprises Tom Cruise, Van Dam and Brook Shield.

Playwrite

Whether the playwrite is a well known man of letters, digest writer or a professional playwrite?

For example, whether the playwrite is Ian Flaming, Shakespeare or Aldous Huxley?

International Value

It refers to how the show is received in other countries and by the overseas viewers of the country the channel belongs to. For example, the show ‘Mind Your Language’ is famous in Pakistan for Ali Nadim’s and Ranjeet Singh’s Indo-Pak tussle.

Target Audience

It refers to the group or community the show is concerned with. For example, for ‘Mind Your Language’ the target audience comprised overseas nationals of all countries residing in the UK having difficulty in English.

Adaptation

Adaptation means whether the concept behind the show is partially or completely taken from a novel, short story, a true story, an incidence, theory, some previously telecasted show or it is a remake. For example, OO7 movies are adaptations from Ian Flaming’s OO7 book series. The movie ‘Titanic’ was adapted from the real incidence of the Titanic sinking into the sea and PTV’s show ‘Jinnah se Quaid’ (1997) (telecasted as From Jinnah to Quaid from PTV World during 2013) was an adaptation of Mohtarma Fatima Jinnah’s book ‘Mera Bhai’.

Example

Let B be the subset of the set of attributes Ω. So, (F, B) that will decide which show is to be broadcasted each day is given by

$$(F, B) =$$
$$\{(\lambda_1, \{\omega_1, \omega_5\}), (\lambda_2, \{\omega_2, \omega_3, \omega_4\}), (\lambda_3, \{\omega_2, \omega_3, \omega_4\}), (\lambda_4, \{\omega_1, \omega_4\})$$
$$(\lambda_5, \{\omega_1, \omega_2, \omega_4, \omega_5\}), (\lambda_6, \{\omega_2, \omega_4\}), (\lambda_7, \{\omega_3, \omega_4, \omega_5\})\}$$

The given soft set is tabulated using the characteristic function in the following way.

Consider the soft set (F, B), where B is the choice parameter for channel management.

Suppose

$$h = \begin{cases} 1, & \text{ifh} \in \mathrm{F}(\omega), \\ 0, & \text{ifh} \notin \mathrm{F}(\omega). \end{cases}$$

A fuzzy soft set (F, B) can be represented in a tabular form as Table 4

Table 4. Tabular Representation of Soft Set (F, B)

(F, B)	ω_1	ω_2	ω_3	ω_4	ω_5
λ_1	1	0	0	0	1
λ_2	0	1	1	1	0
λ_3	0	1	1	1	0
λ_4	1	0	0	1	0
λ_5	1	1	0	1	1
λ_6	0	1	0	1	0
λ_7	0	0	1	1	1

where $\omega_i \in B$.

4.1.2. Algorithm for the Broadcasting of Shows on Particular Days

To select the sequence in which shows $\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5, \lambda_6$ and λ_7 are to be telecasted owing to their weighted choice values in a descending order of days, the following algorithm may be followed:

1. Calculate the soft set (F, B).
2. Evaluate set B of choice parameter for channel management.
3. Identify all reduct-soft set of (F, C).

4. Select one reduct-soft set (F, R).
5. Evaluate the weighted table of the soft set (F, R) according to the weights decided by channel management, that is, fuzzy soft set.
6. Compute W_{qi} for λ_i as sum of all weights corresponding to each λ_i as $W_{qi} = \sum \omega_{j.}$
7. Select λ_i for which $W_{qi} = maxW_{qi}$.

If λ_i has more than one value, then values will be placed for telecast in a descending order.

Weights

Assume that channel management sets the parameter by fuzzy mapping from the set of parameters to interval [0,1] as follows:

Star Cast $=\omega_1$=0.8, Writer $=\omega_2$=0.6, International Value $=\omega_3$=0.5,

Target Audiance $=\omega_4$=0.3, Adaptations $=\omega_5$=0.7

Applying these weights, the reduct-softset is evaluated as Table 5.

Table 5. Tabular Representation of Reduct Soft Set

	ω_1	ω_2	ω_3	ω_4	ω_5	Choice Value W_{qi}
λ_1	0.8	0	0	0	0.7	1.5
λ_2	0	0.6	0.5	0.3	0	1.4
λ_3	0	0.6	0.5	0.3	0.7	2.1
λ_4	0.8	0	0	0.3	0	1.1
λ_5	0.8	0.6	0	0.3	0.7	2.4
λ_6	0	0.6	0	0.3	0	0.9
λ_7	0	0	0.5	0.3	0	0.8

4.1.3. Decision

According to the table, show λ_5 will be telecasted on Sunday, show λ_3 on Saturday, show λ_1 on Friday, show λ_2 on Thursday, show λ_4 on Monday, show λ_6 on Tuesday and show λ_7 on Wednesday.

4.2. Case Study 2

The news section of the same channel wants to know which anchor person is best suited for the specific time slot alloted for a program , 4 days a week. Selection is among the 5 anchors $\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5$. The management will take the opinion of its marketing department, social media cell, and two agencies, that is, the advertising agency and the rating agency and of one of its infotainment producers. They have to give their opinion based on the following parameters: $\omega_1 =$ Research Work, $\omega_2 =$ Influential Personality, $\omega_3 =$ Command on Language, $\omega_4 =$ Good Personal Relations with all Fraternities and $\omega_5 =$ Strong Credibility.

These constitute the following set of parameters.

$$\Omega = \{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5\}$$

The opinion given by each one of the agencies, departments and officials in the fuzzy soft sets form (F_1, Ω), (F_2, Ω), (F_3, Ω), (F_4, Ω) and (F_5, Ω) over Λ, where F_1, F_2, F_3, F_4 and F_5 are mappings from Ω onto $P(\Lambda)$ stated as follows:

$$F_1(\omega_1) = \{\frac{\lambda_1}{0.80}, \frac{\lambda_2}{0.70}, \frac{\lambda_3}{0.65}, \frac{\lambda_4}{0.85}, \frac{\lambda_5}{0.65}\},$$

$$F_1(\omega_2) = \{\frac{\lambda_1}{0.95}, \frac{\lambda_2}{0.80}, \frac{\lambda_3}{0.70}, \frac{\lambda_4}{0.65}, \frac{\lambda_5}{0.55}\},$$

$$F_1(\omega_3) = \{\frac{\lambda_1}{0.70}, \frac{\lambda_2}{0.65}, \frac{\lambda_3}{0.55}, \frac{\lambda_4}{0.70}, \frac{\lambda_5}{0.75}\},$$

$$F_1(\omega_4) = \{\frac{\lambda_1}{0.70}, \frac{\lambda_2}{0.90}, \frac{\lambda_3}{0.85}, \frac{\lambda_4}{0.65}, \frac{\lambda_5}{0.45}\},$$

$$F_1(\omega_5) = \{\frac{\lambda_1}{0.85}, \frac{\lambda_2}{0.80}, \frac{\lambda_3}{0.82}, \frac{\lambda_4}{0.80}, \frac{\lambda_5}{0.87}\}.$$

$$F_2(\omega_1) = \{\frac{\lambda_1}{0.82}, \frac{\lambda_2}{0.75}, \frac{\lambda_3}{0.66}, \frac{\lambda_4}{0.86}, \frac{\lambda_5}{0.55}\},$$

$$F_2(\omega_2) = \{\frac{\lambda_1}{0.94}, \frac{\lambda_2}{0.81}, \frac{\lambda_3}{0.72}, \frac{\lambda_4}{0.61}, \frac{\lambda_5}{0.62}\},$$

$$F_2(\omega_3) = \{\frac{\lambda_1}{0.69}, \frac{\lambda_2}{0.64}, \frac{\lambda_3}{0.54}, \frac{\lambda_4}{0.71}, \frac{\lambda_5}{0.70}\},$$

$$F_2(\omega_4) = \{\frac{\lambda_1}{0.71}, \frac{\lambda_2}{0.92}, \frac{\lambda_3}{0.86}, \frac{\lambda_4}{0.67}, \frac{\lambda_5}{0.57}\},$$

$$F_2(\omega_5) = \{\frac{\lambda_1}{0.84}, \frac{\lambda_2}{0.79}, \frac{\lambda_3}{0.81}, \frac{\lambda_4}{079}, \frac{\lambda_5}{0.64}\}.$$

$$F_3(\omega_1) = \{\frac{\lambda_1}{0.80}, \frac{\lambda_2}{0.79}, \frac{\lambda_3}{0.64}, \frac{\lambda_4}{0.78}, \frac{\lambda_5}{0.75}\},$$

$$F_3(\omega_2) = \{\frac{\lambda_1}{0.95}, \frac{\lambda_2}{0.82}, \frac{\lambda_3}{0.73}, \frac{\lambda_4}{0.62}, \frac{\lambda_5}{0.68}\},$$

$$F_3(\omega_3) = \{\frac{\lambda_1}{0.68}, \frac{\lambda_2}{0.63}, \frac{\lambda_3}{0.53}, \frac{\lambda_4}{0.70}, \frac{\lambda_5}{0.69}\},$$

$$F_3(\omega_4) = \{\frac{\lambda_1}{0.72}, \frac{\lambda_2}{0.93}, \frac{\lambda_3}{0.87}, \frac{\lambda_4}{0.69}, \frac{\lambda_5}{0.55}\},$$

$$F_3(\omega_5) = \{\frac{\lambda_1}{0.86}, \frac{\lambda_2}{0.81}, \frac{\lambda_3}{0.83}, \frac{\lambda_4}{0.81}, \frac{\lambda_5}{0.81}\}.$$

$$F_4(\omega_1) = \{\frac{\lambda_1}{0.81}, \frac{\lambda_2}{0.80}, \frac{\lambda_3}{0.65}, \frac{\lambda_4}{0.79}, \frac{\lambda_5}{0.75}\},$$

$$F_4(\omega_2) = \{\frac{\lambda_1}{0.96}, \frac{\lambda_2}{0.83}, \frac{\lambda_3}{0.74}, \frac{\lambda_4}{0.63}, \frac{\lambda_5}{0.76}\},$$

$$F_4(\omega_3) = \{\frac{\lambda_1}{0.69}, \frac{\lambda_2}{0.62}, \frac{\lambda_3}{0.52}, \frac{\lambda_4}{0.71}, \frac{\lambda_5}{0.71}\},$$

$$F_4(\omega_4) = \{\frac{\lambda_1}{0.66}, \frac{\lambda_2}{0.61}, \frac{\lambda_3}{0.51}, \frac{\lambda_4}{0.67}, \frac{\lambda_5}{0.86}\},$$

$$F_4(\omega_5) = \{\frac{\lambda_1}{0.88}, \frac{\lambda_2}{0.83}, \frac{\lambda_3}{0.85}, \frac{\lambda_4}{0.83}, \frac{\lambda_5}{0.77}\}.$$

$$F_5(\omega_1) = \{\frac{\lambda_1}{0.82}, \frac{\lambda_2}{0.78}, \frac{\lambda_3}{0.60}, \frac{\lambda_4}{0.75}, \frac{\lambda_5}{0.71}\},$$

$$F_5(\omega_2) = \{\frac{\lambda_1}{0.89}, \frac{\lambda_2}{0.79}, \frac{\lambda_3}{0.69}, \frac{\lambda_4}{0.58}, \frac{\lambda_5}{0.70}\},$$

$$F_5(\omega_3) = \{\frac{\lambda_1}{0.79}, \frac{\lambda_2}{0.57}, \frac{\lambda_3}{0.51}, \frac{\lambda_4}{0.70}, \frac{\lambda_5}{0.69}\},$$

$$F_5(\omega_4) = \{\frac{\lambda_1}{0.67}, \frac{\lambda_2}{0.60}, \frac{\lambda_3}{0.52}, \frac{\lambda_4}{0.63}, \frac{\lambda_5}{0.79}\},$$

$$F_5(\omega_5) = \{\frac{\lambda_1}{0.89}, \frac{\lambda_2}{0.87}, \frac{\lambda_3}{0.89}, \frac{\lambda_4}{0.79}, \frac{\lambda_5}{0.75}\}.$$

In the matrix form, fuzzy soft sets are represented as follows:

$$(F_1,\Omega)=\begin{bmatrix}0.80 & 0.70 & 0.65 & 0.85 & 0.65\\ 0.95 & 0.80 & 0.70 & 0.65 & 0.55\\ 0.70 & 0.65 & 0.55 & 0.70 & 0.75\\ 0.70 & 0.90 & 0.85 & 0.65 & 0.45\\ 0.85 & 0.80 & 0.82 & 0.80 & 0.87\end{bmatrix}$$

$$(F_2,\Omega)=\begin{bmatrix}0.82 & 0.75 & 0.66 & 0.86 & 0.55\\ 0.94 & 0.81 & 0.79 & 0.61 & 0.62\\ 0.69 & 0.64 & 0.54 & 0.71 & 0.70\\ 0.71 & 0.92 & 0.86 & 0.67 & 0.57\\ 0.84 & 0.79 & 0.81 & 0.79 & 0.64\end{bmatrix}$$

$$(F_3,\Omega)=\begin{bmatrix}0.80 & 0.79 & 0.64 & 0.78 & 0.75\\ 0.95 & 0.82 & 0.73 & 0.62 & 0.76\\ 0.68 & 0.63 & 0.53 & 0.70 & 0.71\\ 0.72 & 0.93 & 0.87 & 0.69 & 0.86\\ 0.86 & 0.81 & 0.83 & 0.81 & 0.77\end{bmatrix}$$

$$(F_4,\Omega)=\begin{bmatrix}0.81 & 0.80 & 0.65 & 0.79 & 0.75\\ 0.96 & 0.83 & 0.74 & 0.63 & 0.76\\ 0.69 & 0.62 & 0.52 & 0.71 & 0.71\\ 0.66 & 0.61 & 0.51 & 0.67 & 0.86\\ 0.88 & 0.83 & 0.85 & 0.83 & 0.77\end{bmatrix}$$

$$(F_5,\Omega)=\begin{bmatrix}0.82 & 0.78 & 0.60 & 0.75 & 0.71\\ 0.89 & 0.79 & 0.69 & 0.58 & 0.70\\ 0.79 & 0.57 & 0.51 & 0.70 & 0.69\\ 0.67 & 0.60 & 0.52 & 0.63 & 0.79\\ 0.89 & 0.87 & 0.89 & 0.79 & 0.75\end{bmatrix}$$

Since we now have all the fuzzy soft matrices formed by all the agencies and officials giving an opinion, we apply the following algorithm to select the anchor person.

4.2.1. Algorithm for the Selection of Anchor Person for a Particular Slot

Step 1. Find the average of all the matrices (F_1,Ω), (F_2,Ω), (F_3,Ω),

(F_4, Ω) and (F_5, Ω) as B. This acts as FS-agg matrix (F, B) over Λ.

Step 2. Find the c-set $c(F, B)$ of (F, B).

Step 3. Compute $F * B$ of (F, B).

Step 4. Identify the best suited choice by calculating the largest value of the set $F * B$.

Step 1

The average of these matrices is given by

$$(F, B) = \begin{bmatrix} 0.8100 & 0.7640 & 0.6400 & 0.8060 & 0.6820 \\ 0.9380 & 0.8100 & 0.7300 & 0.6180 & 0.6780 \\ 0.7100 & 0.6220 & 0.5300 & 0.7040 & 0.7120 \\ 0.6920 & 0.7920 & 0.7220 & 0.6620 & 0.7060 \\ 0.8640 & 0.8200 & 0.8400 & 0.8040 & 0.7600 \end{bmatrix}$$

Step 2

We calculate the c-set for $c(F, B)$ of the average matrix as follows:

1. $\mu_{c(F_B)}(\omega_1) = \frac{0.8100+0.7640+0.6400+0.8060+0.6820}{5} = 0.7404$
2. $\mu_{c(F_B)}(\omega_2) = \frac{0.9380+0.8100+0.7300+0.6180+0.6780}{5} = 0.7548$
3. $\mu_{c(F_B)}(\omega_3) = \frac{0.7100+0.6220+0.5300+0.7040+0.7120}{5} = 0.6556$
4. $\mu_{c(F_B)}(\omega_4) = \frac{0.6920+0.7920+0.7220+0.6620+0.7060}{5} = 0.7148$
5. $\mu_{c(F_B)}(\omega_5) = \frac{0.8640+0.8200+0.8400+0.8040+0.7600}{5} = 0.8176$

Therefore, the c-matrix is given by

$$c(F, B) = \begin{bmatrix} 0.7404 \\ 0.7548 \\ 0.6556 \\ 0.7148 \\ 0.8176 \end{bmatrix}$$

and on set form as

$$c(F,B) = \{0.8028/\omega_1, 0.7616/\omega_2, 0.6924/\omega_3, 0.7180/\omega_4, 0.7076/\omega_5,\}$$

Step 3

The aggregate fuzzy set $M \circ F * B$ is computed as

$$M \circ F * B = \frac{1}{5}\begin{bmatrix} 0.8100 & 0.7640 & 0.6400 & 0.8060 & 0.6820 \\ 0.9380 & 0.8100 & 0.7300 & 0.6180 & 0.6780 \\ 0.7100 & 0.6220 & 0.5300 & 0.7040 & 0.7120 \\ 0.6920 & 0.7920 & 0.7220 & 0.6620 & 0.7060 \\ 0.8640 & 0.8200 & 0.8400 & 0.8040 & 0.7600 \end{bmatrix} \times \begin{bmatrix} 0.7404 \\ 0.7548 \\ 0.6556 \\ 0.7148 \\ 0.8176 \end{bmatrix} = \begin{bmatrix} 0.5459 \\ 0.5561 \\ 0.4855 \\ 0.5267 \\ 0.6010 \end{bmatrix}$$

In the set form, it is given by

$$F * B = \{0.5459/\lambda_1, 0.5561/\lambda_2, 0.4855/\lambda_3, 0.5267/\lambda_4, 0.6010/\lambda_5\}$$

Step 4

From the aggregate matrix, it was found that anchor person λ_5 is the best suited choice for the management of TV channel.

5. Conclusion

In this paper, we solved a decision-making problem for channel management regarding the broadcasting of seven different shows on seven different days at prime time. We solved another problem in which an anchor person was selected for a specific slot based on the ranks / grades allotted by five different sources. The problems discussed in this article have opened new meadows where all complex decision-making by channels and their consequent problems can be resolved saving them time, money and preventing delays.

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