A New Fuzzy Tool Multi- Impacts Resolving Fuzzy Cognitive Maps (MIRFCM) to Analyze the Factors Causing Work Life Imbalance

J Befija Minnie
PG and Research Department of Mathematics
Loyola College, Chennai-34, India

A. Victor Devadoss
PG and Research Department of Mathematics,
Loyola College, Chennai-34, India

ABSTRACT
There are many fuzzy models available to study social problems. The incorporation of fuzzy models to study the social problems is because of the linguistic nature of the problems. In this study, an attempt is made to study the social problem is that factors causing work life imbalance with a new fuzzy tool which will detail the measure of influence of each factor on the other one. The new fuzzy tool, Multi-Impacts Resolving Fuzzy Cognitive Maps (MIRFCM) is designed to highlight the relationship between the attributes in the system with measures given by the experts and to find out the impact value of each attribute on the other attribute more accurately than any other existing fuzzy models. Some new definitions called 'impact', 'Impact Assignment Function' and 'Multi-Impact Resolution functions' are developed in order to design the new fuzzy model Multi- Impacts Resolving Fuzzy Cognitive Maps.

General Terms
Fuzzy, Multi impact Resolving Fuzzy Cognitive maps, Work life balance

Keywords
Fuzzy, Fuzzy cognitive mapping, Impact, Impact Assignment, Multi –Impact Resolution, Multi- Impacts Resolving Fuzzy Cognitive Maps, Work life balance.

1. INTRODUCTION
Lofti A. Zadeh proposed the idea of Fuzzy sets in 1965. He introduced the membership function with a range covering the interval [0,1] and operating on the domain of all possible values. In 1976, Political scientist Riobert Axelrod used a model called cognitive maps for representing social scientific knowledge. Later, professor Bark Kasko introduced Fuzzy Cognitive Maps in the year 1986. FCMs are represented by signed directed graphs with feedbacks. A FCM model consists of nodes which represent the important elements of the system and the directed lines labeled with fuzzy values show the strength of the causal conditions between the factors. Using FCMs, the influence of the factors on each other can be calculated iteratively. Simple FCMs have edge values in {-1,0,1}. Then if causality occurs, it occurs to maximal positive or negative degree. Simple FCMs provide a quick first approximation to an expert's stated or printed causal knowledge. The existing FCM models are used to study the influence of one attribute on other attributes. In order to determine the measurable value of direct and indirect influence of each attribute on the system, a new fuzzy tool called *Multi- Impacts Resolving Fuzzy Cognitive Maps* (MIRFCM) is introduced with an application of analyzing the factors causing work life imbalance. In this paper, some new definitions called '*impact*' '*Impact Assignment Function*' '*Multi-impact Resolution functions*' are also introduced to build the new fuzzy tool Enhanced Fuzzy Cognitive Mapping.

2. DEFINITION AND ILLUSTRATION OF FUZZY COGNITIVE MAPS

2.1 Definitions
Definition 2.1.1: An FCM is a directed graph with concepts like policies, events etc. as nodes and causalities as edges. It represents causal relationship between concepts.[14]

Definition 2.1.2: FCMs with edge weights or causalities from the set {–1, 0, 1}, are called simple FCMs.[14]

Definition 2.1.3: Consider the nodes or concepts $C_1, \ldots. C_n$ of the FCM. Suppose the directed graph is drawn using edge weight $e_{ij} \in \{0, 1, -1\}$. The matrix E be defined by $E = (e_{ij})$ where e_{ij} is the weight of the directed edge $C_i C_j$. E is called the adjacency matrix of the FCM, also known as the connection matrix of the FCM.[14]

Definition 2.1.4: Let $C_1, \ldots. C_n$ be the nodes of an FCM. $A = (a_1, a_2, \ldots., a_n)$ where $a_i \in \{0, 1\}$. A is called the instantaneous state vector and it denotes the on-off position of the node at an instant.

$a_i = 0$ if a_i is off and

$a_i = 1$ if a_i is on for $i = 1, 2, \ldots, n$.[14]

Definition2.1.5: Let $\overline{C_1C_2}, \overline{C_1C_2}, \ldots\ldots. \overline{C_{n-1}C_n}$ be a cycle. When C_i is switched on and if the causality flows through the edges of a cycle and if it again causes C_i, we say that the dynamical system goes round and round. This is true for any node C_i, for $i = 1, 2, \ldots, n$. The equilibrium state for this dynamical system is called the hidden pattern.[14]

2.2 Method of finding the Hidden Pattern of FCMs
Let $C_1, C_2, ., C_n$ be the nodes of an FCM, with feedback. Let E be the associated adjacency matrix. Let us find the hidden pattern when $C_1$is switched on. When an input is given as the vector $A_1 = (1, 0, 0, ., 0)$, the data should pass through the relation matrix E. This is done by multiplying A_1 by the matrix E. Let $A_1E = (a_1, a_2, ., a_n)$ with the threshold operation that is by replacing a_i by 1 if $a_i < k$ and a_i by 0 if $a_i < k$ (k is a suitable positive integer).We update the resulting concept, the concept C_1 is included in the updated vector by making the first coordinate as 1 in the resulting vector. Suppose $A_1E \rightarrow A_2$

then consider A_2E and repeat the same procedure. This procedure is repeated till we get a limit cycle or a fixed point.[14]

3. DEFINITION AND ILLUSTRATION OF IMPACTS

3.1 Impacts

Definition 3.1.1: A fuzzy set λ_{AxA} on the set AxA is a mapping of each element of AxA to a unique element in the interval [0,1] is described as follows:

$$\lambda: AxA \rightarrow [0,1]$$

where A is the set of nodes in a non simple FCM. The measurable value of influence of an attribute A_k over the attribute A_i in the fuzzy interval [0,1] which is represented as $\lambda^t(A_k, A_i)$ is the *impact* of A_k over A_i at any instant t.

Definition 3.1.2: Consider $A_1, A_2, \ldots, A_n$ are the nodes or concepts of the non simple FCM. Suppose the directed graph is drawn using the edge weight from the fuzzy interval [0, 1], then the matrix derived from the graph is defined by $D = (d_{ij})$, where d_{ij} is the weight of the directed edge A_iA_j. D is called the adjacency matrix of the non simple FCM and also known as the connection matrix of the non simple FCM.

3.2 Impact Assignment

Case (1):

Suppose there exists two attributes or nodes, then the impact of one attribute on the other is given as a definition below.

Definition 3.2.1: Consider A_k is the initial active node at $t=0$ and if A_i is immediate successor of A_k, then the impact of attribute A_k over the attribute A_i at the instant t is given by the transition weight d_{ij}.

Example 3.2.1.

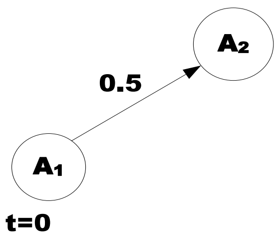


Fig.3.1

In fig.3.1, $\lambda^1(A_2, A_4) = 0.23$. This means that an attribute which is fully active has caused an impact of 0.23 on its successor.

Case (2):

Suppose A_i is not an immediate successor of A_k, there exists a single path of transitions between A_k to A_i as, $A_k = A_1, A_2, \ldots, A_m = A_i$, then a function called *impact assignment function* is introduced to compute the measure of impact of A_k over A_i .

Definition 3.2.2. In a non simple FCM, the *impact assignment function* is a mapping F_1:[0,1]x[0,1] $\rightarrow$ [0,1] which is applied via augmented transition function to assign impact values to the active states. The function $F_1(\lambda, d)$ is defined on two parameters namely λ and d, where λ denotes the impact value of the predecessor and d denotes the weight of the transition.

The process of computing the impact value of A_1 over A_m when there exists a single path of transitions $A_1, A_2, \ldots, A_m$ is represented as:

$$\lambda^{t+1}(A_1, A_m) = F_1\left(\lambda^t(A_1, A_{m-1}), d_{(m-1),m}\right)$$

where the function F_1 should satisfy the following axioms:

Axiom 1. $0 \leq F_1(\lambda, d) \leq 1$.

Axiom 2. $F_1(0, 0) = 0$ and $F_1(1, 1) = 1$.

where axiom 2 guarantees the boundary conditions.

The function $F_1(\lambda, d)$ can be applied for many mathematical operations like

$$F_1(\lambda, d) = \text{Mul}\ (\lambda, d) = \lambda d$$

$$F_1(\lambda, d) = \text{Mean}\ (\lambda, d) = \frac{\lambda + d}{2}$$

$$F_1(\lambda, d) = \text{GMean}\ (\lambda, d) = \sqrt{\lambda d}$$

$$F_1(\lambda, d) = \begin{cases} \text{Max}\ (\lambda, d) & if\ t < t_i \\ \text{Min}(\lambda, d) & if\ t \geq t_i \end{cases}$$

Any of these options can be used for computation according to the nature of the problem chosen for study.

For better understanding, the definition is explained with an example.

Example 3.2.2.

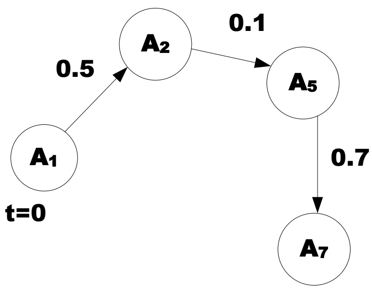


Fig. 3.2

Let $F_1(\lambda, d) = \text{Mul}\ (\lambda, d) = \lambda d$, then

$$\lambda^1(A_1, A_2) = 0.5$$

$$\lambda^2(A_1, A_5) = F_1\left(\lambda^1(A_1, A_2), d_{2,5}\right) = F_1(0.5, 0.1) = 0.05$$

$$\lambda^3(A_1, A_7) = F_1\left(\lambda^2(A_1, A_5), d_{5,7}\right) = F_1(0.05, 0.7) = 0.035$$

3.3 Multi Impact Resolutions

Case (3):

Suppose there exists two or more paths of transitions from A_k to A_i, then a function called *multi-impact resolution function* is introduced to compute the measure of impact of A_k over A_i by resolving the multi-impact values to a single impact value.

Definition 3.3.3: In a non simple Fuzzy Cognitive Map, the *multi-impact resolution function*, which is denoted by F_2, is a mapping F_2:[0,1]* $\rightarrow$[0,1] which specifies the strategy of computation of impact values and it resolves the multi-impact active values to a single impact value with the following axioms to be satisfied by F_2

Axiom 1. $0 \le F_2(\boldsymbol{\lambda_i}) \le 1,\ \forall\, i = 1, 2, \ldots n$

Axiom 2. $F_2(\phi) = 0$.

Axiom 3. $If\ \lambda_i = a, F_2(\boldsymbol{\lambda_i}) = a, \forall\, i = 1, 2, \ldots n$

Similar to F_1, the function F_2 can be applied for many mathematical operations. The best-fitted strategy should be selected based on the requirements of the problem chosen for study.

where n is the number of simultaneous transitions from A_1 to A_m at time $t+1$, and A_i is a predecessor of A_m.

Example 3.3.3

Consider the process of calculating the impact values of A_1 to A_7 where there are four possible paths exist from A_1 to A_7.

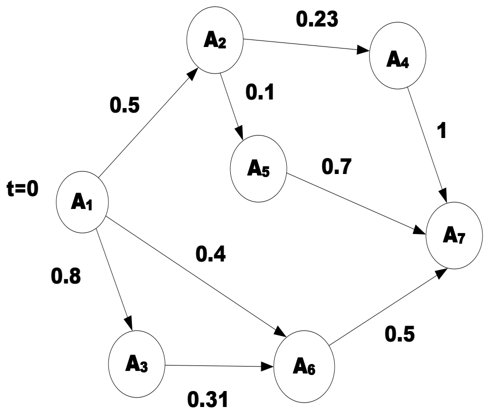


Fig.3.3

Let $F_1(\boldsymbol{\lambda}, d) = \text{Mul}\,(\boldsymbol{\lambda}, d) = \boldsymbol{\lambda} d$, then

$\lambda^3(A_1, A_7) = 0.115\ [via\ A_1 \to A_2 \to A_4 \to A_7]$

$\lambda^3(A_1, A_7) = 0.035\ [via\ A_1 \to A_2 \to A_5 \to A_7]$

$\lambda^3(A_1, A_7) = 0.20\ [via\ A_1 \to A_6 \to A_7]$

$\lambda^3(A_1, A_7) = 0.124\ [via\ A_1 \to A_3 \to A_6 \to A_7]$

Thus $\lambda^3(A_1, A_7) = \{0.115,\ 0.035,\ 0.20,\ 0.124\}$, leading to multi-impact values.

In order to determine the measure of impact of A_1 over A_7 the multi-impact values have to be resolved into a single impact value with the help of the multi-impact resolution function F_2.

Let's consider the following strategies to resolve the multi impact values.

- Maximum multi- impact resolution:

$$\lambda^{t+1}(A_1, A_m) = F_2\left[F_1\left(\lambda^t(A_1, A_i), d_{i,m}\right)\right]$$

$$= \underset{i}{Max}\left[F_1\left(\lambda^t(A_1, A_i), d_{i,m}\right)\right], \forall\, i = 1, 2, \ldots n$$

- Arithmetic mean multi- impact resolution:

$$\lambda^{t+1}(A_1, A_m) = F_2\left[F_1\left(\lambda^t(A_1, A_i), d_{i,m}\right)\right]$$

$$= \frac{\sum_i \left[F_1\left(\lambda^t(A_1, A_i), d_{i,m}\right)\right]}{n}, \forall\, i = 1, 2, \ldots n$$

4. MULTI – IMPACT RESOLVING FUZZY COGNITIVE MAPS

4.1 Definitions

Definition 4.1.1: An *Multi- Impacts Resolving Fuzzy Cognitive Maps* (MIRFCM) is a non simple FCM. It can be represented as a directed graph with concepts like policies, events etc. as nodes and causalities as edges. It represents causal relationship between concepts. The directed graph is drawn using the edge weight from the fuzzy interval [0, 1], then the MIRFCM matrix derived from the graph is defined by $D = (d_{ij})$, where d_{ij} denotes the edge weight. In this MIRFCM, F_1 and F_2 are the impact assignment function and the multi-impact resolution function respectively.

Definition 4.1.2: Let $A_1, A_2, \ldots, A_n$ be the nodes of an MIRFCM. $B^{k,t} = (b_1^{k,t}, b_2^{k,t}, \ldots, b_n^{k,t})$ where $b_j^{k,t} \in [0, 1]$. $B^{k,t}$ is called the instantaneous state vector of MIRFCM.

$b_j^{k,t}$ is defined by, $b_j^{k,t} = \begin{cases} 1, & j = k \\ F_2\left[F_1\left[b_i^{k,t-1}, d_{i,j}\right]\right], & j \neq k \end{cases}$

$\forall\, i = 1, 2, \ldots n;\ j = 1, 2, \ldots n$

and $b_j^{k,t}$ denotes the impact value of A_k over A_j at any instant 't' [i.e. $b_j^{k,t} = \lambda^t(A_k, A_j)$].

Definition 4.1.3: In specific, $B^{k,0}$ is called the initial state vector of MIRFCM and it denotes the on-off position of the node at the instant '$t=0$'.

$b_j^{k,0} = \begin{cases} 1, & j = k \text{ (on state)} \\ 0, & j \neq k \text{ (off state)} \end{cases}$

for $j = 1, 2, ., n$.

Definition 4.1.4: For each relation matrix $D = (d_{ij})$ of MIRFCM, a corresponding relation matrix $E = (e_{ij})$ of simple FCM can be obtained as follows:

$e_{ij} = 1$ (*if* $d_{ij} > 0$)

$e_{ij} = 0$ (*if* $d_{ij} = 0$)

*Definition 4.1.5***:** Let $A_1, A_2, \ldots, A_n$ be the nodes of MIRFCM. $C^{k,t} = (c_1^{k,t}, c_2^{k,t}, \ldots, c_n^{k,t})$ where $c_j^{k,t} \in \{0, 1\}$. $C^{k,t}$ is called the instantaneous state vector of its simple FCM and $c_j^{k,t}$ denotes the on-off position of the node at the instant 't'.

$c_j^{k,t} = 1$ (on state) and $c_j^{k,t} = 0$ (off state)

for $j = 1, 2, ., n$.

Definition 4.1.6: An MIRFCM is said to halt, if its corresponding simple FCM settles down in equilibrium with its limit cycle over the instantaneous state vector $C^{k,t}$.

4.2 Applications of MIRFCM

Model I: MIRFCM[Mul, Avg]

This is a *Multi- Impacts Resolving Fuzzy Cognitive Maps* (MIRFCM) with $F_1(\boldsymbol{\lambda}, d) = \text{Mul}\,(\boldsymbol{\lambda}, d) = \boldsymbol{\lambda} d$ and F_2 as Arithmetic mean multi- impact resolution.

The instantaneous state vector of MIRFCM, $B^{k,t} = (b_1^{k,t}, b_2^{k,t}, \ldots, b_n^{k,t})$ and

$b_j^{k,t}$ is defined by,

$$b_j^{k,t} = \begin{cases} 1, & j = k \\ 0, & \alpha = 0 \\ \dfrac{\sum_{i=1}^{n} \left(b_j^{k,t-1}\right)\left(d_{i,j}\right)}{\alpha}, & \alpha \neq 0 \end{cases}$$

where $\alpha = \sum_{i=1}^{n} \left(c_i^{k,t-1}\right)\left(e_{i,j}\right)$, ∀ j=1,2,…n

Model II: MIRFCM[Mul, Max]
This is a *Multi- Impacts Resolving Fuzzy Cognitive Maps* (MIRFCM) with $\mathrm{F}_1(\boldsymbol{\lambda}, d) = \mathrm{Mul}\,(\boldsymbol{\lambda}, d) = \boldsymbol{\lambda} d$ and F_2 as Maximum multi- impact resolution.

$b_j^{k,t}$ is defined by,

$$b_j^{k,t} = \begin{cases} 1, & j = k \\ \underset{i}{Max}\,\{(b_i^{k,t-1})(d_{i,j})\}, & j \neq k \end{cases}$$

$\forall\ \mathrm{i} = 1, 2, \ldots \mathrm{n};\ \mathrm{j} = 1,2, \ldots \mathrm{n}$

Model III: MIRFCM[Avg, Avg]
This is an *Multi- Impacts Resolving Fuzzy Cognitive Maps* (MIRFCM) with $\mathrm{F}_1(\boldsymbol{\lambda}, d) = \mathrm{Mul}\,(\boldsymbol{\lambda}, d) = \boldsymbol{\lambda} d$ and F_2 as Arithmetic mean multi- impact resolution.

$b_j^{k,t}$ is defined by,

$$b_j^{k,t} = \begin{cases} 1, & j = k \\ 0, & \alpha = 0 \\ \dfrac{\dfrac{\sum_{i=1}^{n} \left(b_j^{k,t-1}\right) + \left(d_{i,j}\right)}{2}}{\alpha}, & \alpha \neq 0 \end{cases}$$

where $\alpha = \sum_{i=1}^{n} \left(c_i^{k,t-1}\right)\left(e_{i,j}\right)$, ∀ j=1,2,…n

5. ADAPTATION OF MIRFCM [Mul, Avg] TO THE PROBLEM

5.1 Work Life Balance

Work-life balance, in its broadest sense, is defined as a satisfactory level of involvement or 'fit' between the multiple roles in a person's life (Hudson, 2005).

Work life balance is very subjective in nature and it depends on people's perception.[20] Work-life balance is having the 'right' combination of participation in paid work (defined by hours and working conditions) and other aspects of their lives.[2]This combination will change as people move through life and have changing responsibilities and commitments in their work and personal lives.[5] The imbalance also has a negative impact in the personal life of working people-some of which have even become social hazards- increasing number of divorces, infertility due high stress levels, advent of nuclear families etc. [6]

5. 2 Personal Life Factors

Any factors which are not related to the professional life will be considered as personal factors. Personal factors will have a huge impact on work life balance as it has the direct impact on the personality of the person and in his professional life. So, it is imperative to maintain a harmony in personal life in order to limit the adverse effect of work life imbalance [20]

It is obvious to understand the personal life factors such as 'unsupported spouse', 'child care', 'too much of household activities', etc. will reduce the balancing and ultimately will reflect in the professional life. In order to maintain a good record of professional for a person, it is must for him to have cordial relationship with his family members and spouse. [20]

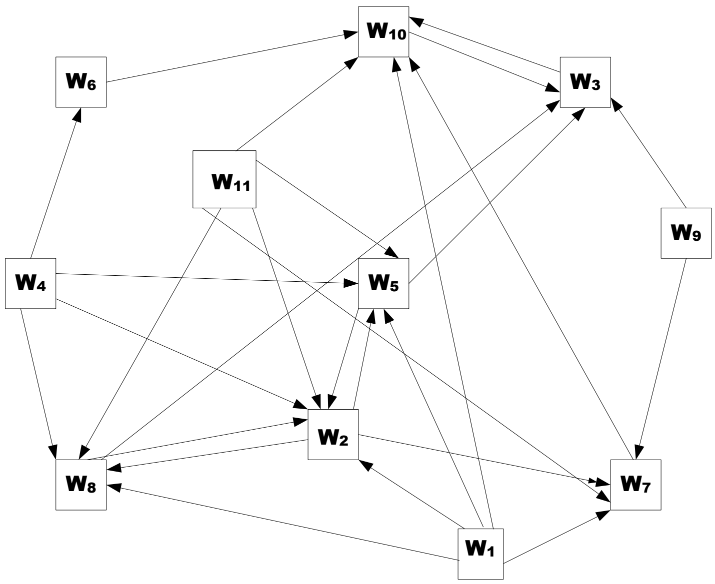
Also, professional life factors are also affecting the individual's personal life to some extend with the less magnitude of what personal life does on the professional life.[20]

There may be a single factor or a group of factors ruining both personal and professional life; it is not universal for all. It is very specific with individuals. So, understanding this concept is very difficult and thus it requires a model which studies the linguistic based data and gives the accurate and reliable outcome. Here, the use of fuzzy model is obtained to study the manual data.

The following attributes are taken as the nodes of the MIRFCM.

W_1- Unsupported Spouse
W_2- Too much of household activities
W_3- Inadequate sleep
W_4- Financial burden
W_5- Difficulties in managing child care requirements
W_6 – No proper food
W_7- No proper time for personal care
W_8- Difficulties in caring ill/aged family members
W_9- Long travelling hours to work
W_{10}- Health problems
W_{11} – Lack of support from family members

The following graph is the relation graph given by the expert's opinion



The following connection matrix D is given on the basis of expert's opinion

D=

0	0.7	0	0	0.8	0	0.5	0.7	0	0.4	0
0	0	0	0	0.8	0	0.7	0.6	0	0	0
0	0	0	0	0	0	0	0	0	0.8	0
0	0.2	0	0	0.4	0.7	0	0.5	0	0	0
0	0.3	0.5	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0.7	0
0	0	0	0	0	0	0	0	0	0.6	0
0	0.5	0.6	0	0	0	0	0	0	0	0
0	0	0.5	0	0	0	0.4	0	0	0	0
0	0	0.4	0.7	0	0	0	0	0	0	0
0	0.8	0	0	0.6	0	0.3	0.7	0	0.4	0

The corresponding connection matrix E of simple FCM is

E=

0	1	0	0	1	0	1	1	0	1	0
0	0	0	0	1	0	1	1	0	0	0
0	0	0	0	0	0	0	0	0	1	0
0	1	0	0	1	1	0	1	0	0	0
0	1	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	1	0
0	1	1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	1	0	0	0	0
0	0	1	1	0	0	0	0	0	0	0
0	1	0	0	1	0	1	1	0	1	0

													$C^{1,0}$	1	0	0	0	0	0	0	0	0	0	0
$C^{1,0}E$	0	1	0	0	1	0	1	1	0	1	0	→	$C^{1,1}$	1	1	0	0	1	0	1	1	0	1	0
$C^{1,1}E$	0	3	3	1	2	0	2	2	0	2	0	→	$C^{1,2}$	1	1	1	1	1	0	1	1	0	1	0
$C^{1,2}E$	0	4	3	1	3	1	2	3	0	3	0	→	$C^{1,3}$	1	1	1	1	1	1	1	1	0	1	0
$C^{1,3}E$	0	4	3	1	3	1	2	3	0	4	0	→	$C^{1,4}$	1	1	1	1	1	1	1	1	0	1	0

$B^{1,0}$	1	0	0	0	0	0	0	0	0	0	0
$B^{1,1}$	1	0.7	0	0	0.8	0	0.5	0.7	0	0.4	0
$B^{1,2}$	1	0.43	0.3267	0.28	0.68	0	0.495	0.56	0	0.35	0
$B^{1,3}$	1	0.31	0.272	0.245	0.4187	0.196	0.4005	0.366	0	0.3194	0
$B^{1,4}$	1	0.2644	0.1856	0.2236	0.382	0.1715	0.3585	0.3362	0	0.2488	0

6. RESULTS AND DISCUSSION

Now let's consider all the results obtained by having each attributes in on state in the below table.

Attribute	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9	W_{10}	W_{11}
W_1	1	0.2644	0.1856	0.2236	**0.382**	0.1715	0.3585	0.3362	0	0.2488	0
W_2	0	1	0.1919	0.2314	0.4467	0.1635	**0.7**	0.3584	0	0.2608	0
W_3	0	0.0819	1	0.376	0.1546	**0.392**	0.0745	0.1719	0	0.3738	0
W_4	0	0.1463	0.174	1	0.276	**O.7**	0.133	0.307	0	0.258	0
W_5	0	0.1487	**0.2377**	0.1841	1	0	0.1365	0.1285	0	0.1654	0
W_6	0	0.0606	0.1148	**0.3234**	0.1019	1	0.0652	0.1088	0	0.2853	0
W_7	0	0.0789	0.1228	0.2772	0.1176	0.294	1	0.1302	0	**0.3326**	0
W_8	0	0.2019	**0.2635**	0.1661	0.1399	0.1691	0.1603	1	0	0.1817	0
W_9	0	0.0426	0.1776	0.1719	0.0627	0.1568	**0.2157**	0.0694	1	0.2003	0
W_{10}	0	0.1024	0.2094	**0.7**	0.1932	0.49	0.0931	0.2149	0	1	0
W_{11}	0	0.2829	0.1727	0.2083	0.3162	0.1421	0.267	**0.334**	0	0.2321	1

7. CONCLUSION

The result clearly indicates that which attribute has the maximum impact when a particular attribute on state. The result clearly indicates that which attribute has the maximum impact when a particular attribute on state.

a) The attribute W_1 has the maximum impact on attribute W_5 with the impact value of 0.382

b) The attribute W_2 has the maximum impact on $W_7$with the impact value of 0.7

c) The attribute W_3 has the maximum impact on attribute W_6 with the impact value of 0.392

d) The attribute W_4 has the maximum impact on attribute W_6 with the impact value of 0.7

e) The attribute W_5 has the maximum impact on attribute W_3 with the impact value of 0.2377

f) The attribute W_6 has the maximum impact on attribute W_4 with the impact value of 0.3234

g) The attribute W_7 has the maximum impact on attribute W_{10} with the impact value of 0.3326

h) The attribute W_8 has the maximum impact on attribute W_3 with the impact value of 0.2635

i) The attribute W_9 has the maximum impact on attribute W_7 with the impact value of 0.2157

j) The attribute W_{10} has the maximum impact on attribute W_4 with the impact value of 0.7

k) The attribute W_{11} has the maximum impact on W_8 with the impact value of 0.334.

8. FUTURE DIRECTION

This paper studied how the impact values keep the study more problem oriented. Since the studies of social issues are more complicated in nature, the requirement of new models became necessary. Especially, in the field of work life balance, there are many factors affecting the harmony of it. Every factor has its own impact level which is subject to person to person and issue to issue. So defining a general model dealing with pre defined impact values will not be sufficient to address the issue, so a model which is sensitive to the ground issues are need to be developed to deal with such inconsistency became mandatory. The scope of the study lays here, the impact value and impact effect need to be defined by the problem by considering the subjectivity of the issue. Also, many factors of work life balance need be addressed with these models such as personality influence, organizational factors, financial requirements, unsupported government, etc.

9. REFERENCES

[1] Barbara Haddon and Andrew Hede, "*Work life Balance – An integrated Approach*", (2010).

[2] Byrne, U. "*Work-life balance: Why are we talking about it at all*", Business Information Review, Vol. 22, pp: 53-59, (2005)

[3] Chan Suk-fun, Isabella, "*Work life balance: A study on the effect of conflict and facilitation amongst life roles on psychological well being and quality of life of individuals in Hong Kong*", (2007).

[4] Fiona Jones, Ronald Burke and Mina Westman, "*Work-Life Balance: A Psychological Perspective*", Psychology press (UK), (2006).

[5] Fiona Moore, "*Work-life balance: Contrasting managers and workers in an MNC*", Employee Relations, Vol. 29, Issue 4, pp: 385-399, (2007).

[6] Frank Bauer, Hermann Grob, Gwen Oliver, Georg Sieglen and Mark Smith, "*Time use and work–life balance in Germany and the UK*", (2007).

[7] Hughes, J. and Bozionelos, N. "*Work-life balance as source of job dissatisfaction and withdrawal attitudes: An exploratory study on the views of male workers*", Personnel Review. Vol. 36, pp: 145-154, (2007).

[8] Kosko B., "*Neural Networks and Fuzzy Systems"*, Prentice-Hall, Inc., New Jersey, USA, (1992).

[9] Kosko B.," *Fuzzy Cognitive Maps"*, Int, J. Man-Machine studies, 24, 65-75, (1986)

[10] Morris, M. L. and Madsen, S. R., "*Advancing work-life integration in individuals, organizations, and communities*", Advances in Developing Human Resources. Vol. 9, pp: 439-454, (2007).

[11] Mansoor Doostfatemeh and Stefan C. Kremer, "New *Directions in Fuzzy Automata*", International Journal of Approximate Reasoning, pp: 175-214, (2005)

[12] Pathinathan T., et al., "*On tensions and Causes for school Drop outs – An Induced Linked Fuzzy Relational Mapping (ILFRM) Analysis",* In Proc.of the 9th Joint Conference on Information Sciences (JCIS), pp: 1160-1163, (2006).

[13] Niharika Doble and Supriya, M.V, "*Gender differences in the perception of work life balance*", (2010).

[14] Vasantha Kandasamy W.B and Florentin Smarandache, "*Fuzzy Cognitive Maps and Neutrosophic Cognitive Maps*", (2003).

[15] Vasantha Kandasamy W.B and Florentin Smarandache, "*Analysis of social aspects of migrant labourers living with HIV/AIDS using fuzzy theory and neutrosophic cognitive maps*", (2004).

[16] Vasantha Kandasamy W.B and Florentin Smarandache, "*Fuzzy and Neutrosophic Analysis of Women with HIV/AIDS*", (2005).

[17] Victor Devadoss. A and Befija Minnie. J, "*A study of personality influence in building work life balance using Induced Bi- directional Associative Memories*", International Journal of Engineering Research & Technology, ISSN: 2278-0181, Vol:2, Issue 11, (2013).

[18] Victor Devadoss. A and Befija Minnie. J, "*A study of work related stress factors affecting work life balance using Combined Overlap Block Fuzzy Cognitive Mapping",* International Journal of Computing Algorithm, Vol: 02, pp: 161- 166, (2013)

[19] Victor Devadoss. A and Befija Minnie. J, *"Analyzing the causes of work life imbalance in working environment using Induced Fuzzy Cognitive Maps"*, International Journal of Scientific & Engineering Research, Vol :5, Issue 2, ISSN: 2229- 5518, (2014).

[20] Victor Devadoss. A and Befija Minnie. J, *"Analyzing the Personal Factors Causing Work life Imbalance using Induced Fuzzy Cognitive Mapping",* International Journal of Scientific & Engineering Research, Vol: 5, Issue 6, ISSN:2229-5518, (2014).

[21] Wilkinson, S. J, "*Work-life balance in the Australian and New Zealand surveying profession*", Structural Survey, Vol. 26, Issue 2, pp:120-130,(2008)