possesses a directed cycle. An FCM is said to be acyclic if it does not possess any directed cycle When there is a feedback in an FCM, i.e., when the causal relations flow through a cycle in a revolutionary way, the FCM is called a dynamical system. Let C_1C_2,C_2 C_3, …, C_iC_j 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, …, n. The equilibrium state for this dynamical system is called the hidden pattern. If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point If the equilibrium state of a dynamical state is a unique state vector it is called a fixed point or limit cycle. Inference from the hidden pattern summarizes the joint effects of all interacting fuzzy knowledge.

3. Algorithmic Approach in Induced Fuzzy Cognitive Maps(IFCMs)

IFCM is an advancement of FCM it follows the foundation of FCM; it has a slight modification only in algorithm approaches. The following steps are used for finding IFCM.

Step 1: For the given model (problem) collect the unsupervised data that is in. Determinant factors called nodes
Step 2: According to the expert opinion, draw the directed graph.

Step 3: Obtain the connection matrix, M, from the directed graph (FCM).Here the Number of rows in the given matrix = number of steps to be performed.

Step 4: Consider the state vector C_1 which is in **ON** position. Find C_1×M. The state Vector is updated and threshold at each stage.

Step 5: Threshold values are calculated by assigning 1 for the values >1 and 0 for the
Values <0.The symbol represents the threshold value for the product of the result.

Step 6: Now each component in the C_1 vector is taken separately and product of the given. Matrix is calculated. The vector which has maximum number of one's is found. The vector which has the maximum number of one's which occurs first considered as C_2

Step 7: When the same threshold value occurs twice. The value is considered as the. Fixed point. The iteration gets terminated.

Step 8: Consider the state vector C_1 by setting C_2 ON state that is assigning the Second component of the vector to be 1 and the rest of the components as 0. Precede the Calculations discussed in step 4 to 6

Step 9: Continue Step 9 for all the state vectors and find hidden pattern.

4. Identifying the cause of using Endosulfan – Undetermined factors

We have made a sample survey of 101 people of Kerala (Palakkad and Kasrgode). They were interviewed using a questionnaire relevant to the topic. According to their views some of the factors as indicators are considered for our studies are given as follows. The following are the eleven nodes taken by the experts

P_1 –Population Increase
P_2 –To increase food productivity
P_3 –Cheap cost
P_4 –Easy availability of Endosulfan
P_5- Need better yield
P_6 – Need for pest control
P_7 –Illeteracy
P_8-No awareness on ill effects of Endosulfan
P_9-No knowledge of any other non chemical alternative
P_{10}-Non involvement of social organization
P_{11}-Govt. indifference or negligence in farmers

The following represents the connection graph of the above eleven concepts and its connection matrix

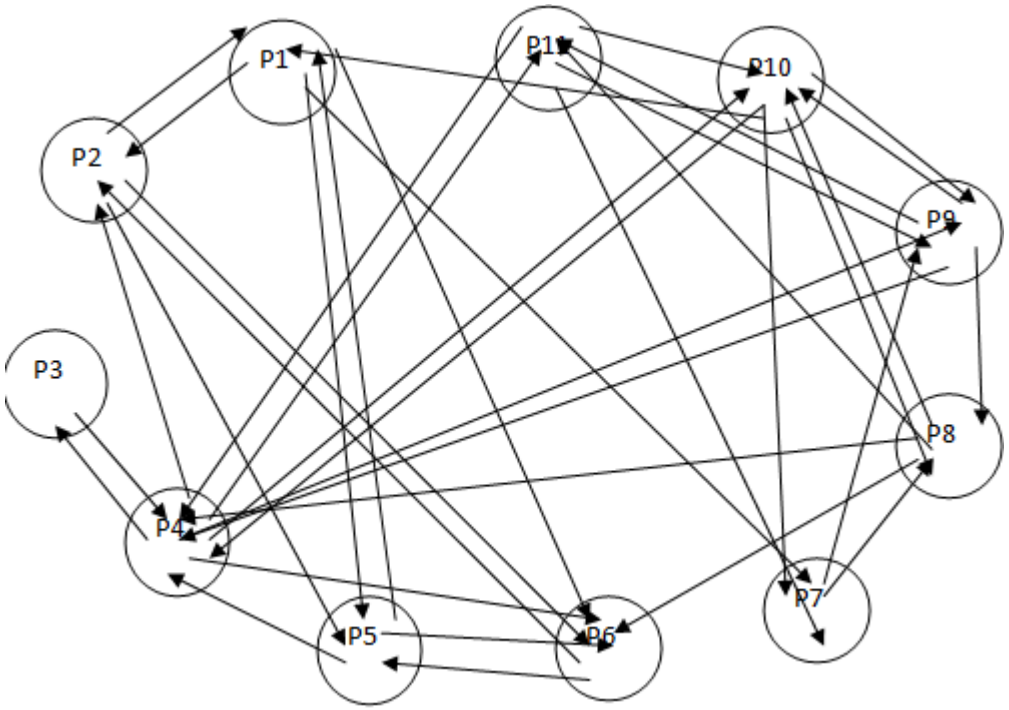

Figure 4.1: Directed graph

M=	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	P_{11}
P_1	0	1	0	0	1	1	1	0	0	0	0
P_2	1	0	0	0	1	1	0	0	0	0	0
P_3	0	0	0	1	0	0	0	0	0	0	0
P_4	0	1	1	0	0	1	0	0	1	1	1
P_5	1	0	0	1	0	1	0	0	0	0	0
P_6	0	1	0	0	1	0	0	0	0	0	0
P_7	0	0	0	0	0	0	0	1	1	0	0
P_8	0	0	0	1	0	1	0	0	0	1	1
P_9	0	0	0	1	0	0	0	1	0	1	1
P_{10}	1	0	0	1	0	0	1	1	1	0	0
P_{11}	0	0	0	1	0	0	1	1	1	0	0

4.2 Connection Matrix

Trial 1:

Let us consider C1 in the trial 1, by setting the concept C8 to ON state, that is the eight component of the vector is set to be 1 and the rest are assigned to 0.

Let C_1 = (0 0 0 0 0 0 0 1 0 0 0 0)

Product of C_1 and M is calculated.

C_1M= (0 0 0 1 0 1 0 0 0 1 1) ↪(0 0 0 1 0 1 0 1 0 1 1)=C_1^1
C_1^1=(0 0 0 1 0 1 0 1 0 1 1)

Threshold value is calculated by assigning 1 for values greater than 1 and 0 for the values less than 0. The symbol ↪ represents the threshold value for the product of the result.

Now C_1^1=(0 0 0 1 0 1 0 1 0 1 1)
C_1^1M=(0 0 0 1 0 1 0 1 0 1 1)M

Now as per Induced Fuzzy Cognitive Map methodology, each component in the C_1' vector is taken separately and product of the given matrix is calculated. The vector which has the maximum number of one's which occurs first is considered as C_2.

The symbol~ denotes the calculation performed with the respective vector,

C_1^1M~ (0 0 0 1 0 0 0 0 0 0 0)M↪(0 1 1 0 0 1 0 0 1 1 1)
C_1^1M=(0 0 0 0 0 1 0 0 0 0 0)M ↪(0 1 0 0 1 0 0 0 0 0 0)
C_1^1M=(0 0 0 0 0 0 0 1 0 0 0)M ↪(0 0 0 1 0 1 0 0 0 1 1)
C_1^1M=(0 0 0 0 0 0 0 0 0 1 0)M ↪(1 0 0 1 0 0 1 1 1 0 0)
C_1^1M=(0 0 0 0 0 0 0 0 0 0 1)M↪(0 0 0 1 0 0 1 1 1 0 0)
C_2= (0 1 1 0 0 1 0 0 1 1 1)
C_2M =(0 1 1 0 0 1 0 0 1 1 1)M=(2 1 0 4 2 1 2 2 2 1 1)

Product of C2 and M is calculated.

↪(1 1 0 1 1 1 1 1 1 1 1)=C_2^1
(1 1 0 1 1 1 1 1 1 1 1)=C_2^1

Similar to the above computation, the vector which has the maximum number of one's is found and left it be C3.
C3=(0 1 1 0 0 1 0 0 1 1 1)=C2

The fixed point is C3=(0 1 1 0 0 1 0 0 1 1 1)

When the same threshold value occurs twice, the value is considered as the fixed point. The iteration gets terminated

and the calculation gets terminated and the calculation for Trial 2 is performed. Similar to the Trial 1, consider C_1 by setting C_9 in ON state that is, assigning the ninth component of the vector to be 1 and the rest of the component as 0.

The fixed point C3=(0 1 1 0 0 1 0 0 1 1 1)

When the same threshold value occurs twice, the value is considered as the fixed point. The iteration gets terminated and the calculation gets terminated and the calculation for Step 2 is performed. Similar to the Step 1, consider C_1 by setting C_9 in ON state that is, assigning the ninth component of the vector to be 1 and the rest of the component as 0.

Trial 2:
Let C1 be

C_1=(0 0 0 0 0 0 0 0 1 0 0)
C_1M= (0 0 0 0 0 0 0 0 1 0 0)M =(0 0 0 1 0 0 0 1 0 1 1)
Product of C_1 and M is calculated.
↪(0 0 0 1 0 0 0 1 1 1 1)=$C_1^{|}$
$C_1^{|}$=(0 0 0 1 0 0 0 1 1 1 1)
$C_1^{|}$M=(0 0 0 1 0 0 0 0 0 0 0)M ↪(0 1 1 0 0 1 0 0 1 1 1)
$C_1^{|}$M=(0 0 0 0 0 0 0 1 0 0 0)M↪(0 0 0 1 0 1 0 0 0 1 1)
$C_1^{|}$M=(0 0 0 0 0 0 0 0 1 0 0)M↪(0 0 0 1 0 0 0 1 0 1 1)
$C_1^{|}$M(0 0 0 0 0 0 0 0 0 1 0)M ↪(1 0 0 1 0 0 1 1 1 0 0)
$C_1^{|}$M(0 0 0 0 0 0 0 0 0 0 1)M ↪(0 0 0 1 0 0 1 1 1 0 0)
Now the vector with maximum number of 1's be C_2.
C_2=(0 1 1 0 0 1 0 0 1 1 1)
C_2M=(2 1 0 4 2 1 2 2 2 1 1) ↪(1 1 0 1 1 1 1 1 1 1 1)
C_2^1=↪(1 1 0 1 1 1 1 1 1 1 1)
Now the vector with maximum number of 1's be C_3.
C_3= (0 1 1 0 0 1 0 0 1 1 1) =
$C_2^{|}$M=(1 0 0 0 0 0 0 0 0 0 0)M
↪(0 1 0 0 1 1 0 0 0 0 0)
$C_2^{|}$M =(0 1 0 0 0 0 0 0 0 0 0)M
↪(1 0 0 0 0 1 1 0 0 0 0 0)
$C_2^{|}$M=(0 0 1 0 0 0 0 0 0 0 0)M
↪(0 0 0 1 0 0 0 0 0 0 0)
$C_2^{|}$M =(0 0 0 1 0 0 0 0 0 0 0)
↪(0 1 1 0 0 1 0 0 0 1 1)
$C_2^{|}$M=(0 0 0 0 0 1 0 0 0 0 0)M
↪(0 1 0 0 1 0 0 0 0 0 0)
$C_2^{|}$M= (0 0 0 0 0 0 1 0 0 0 0)M
↪(0 0 0 0 0 0 0 1 1 0 0)
$C_2^{|}$M=(0 0 0 0 0 0 0 1 0 0 0)M
↪(0 0 0 1 0 0 1 0 1 1 1)
$C_2^{|}$M=(0 0 0 0 0 0 0 0 1 0 0)M
↪(0 0 0 0 0 0 1 1 0 1 1)
$C_2^{|}$M=(0 0 0 0 0 0 0 0 0 1 0)M
↪(1 0 0 1 0 0 1 1 1 0 0)
$C_2^{|}$M=(0 0 0 0 0 0 0 0 0 0 1)M
↪(0 0 1 0 0 0 1 1 0 0)

Now the vector with maximum number od 1's be C_3.

C_3=(0 1 1 0 0 1 0 0 1 1 1)

That is,

C_3=(0 1 1 0 0 1 0 0 1 1 1)=C_2, the fixed point is C_3.

In the above manner, the other trials to be performed. By keeping each vector in ON position, the various fixed points are found.

5. Conclusion

In this study, we have performed two trials. Result of trials 1 suggests, by keeping concept P_8 in ON state, suggests C_4 as the hidden pattern. That is, all the 1's in C_4 are the possible factors revealed from the first factor. More precisely, the factors viz, to increase the food productivity(P_2), cheap cost(P_3), need for pest control(P_6), P_9-No knowledge of any other non chemical alternative(P_9) non involvement of social organization(P_{10}) and Govt. indifference or negligence in farmers(P_{11}) are ON state.

In a similar manner, we can discuss the result of trials 2. In trials 2, we kept P_9 in ON position and we have derived C_4 as the hidden pattern. C_4 contains the factors in ON state are nothing but the factors which are discussed in trials 1. So by taking 'No knowledge of any other non chemical alternative' factors also we obtain the same implications. Likewise if we choose other factors in ON position, we derive corresponding implication factors.

Two further results are worthy of consideration in the present study. First, by observing the above calculation of IFCM done in trials 1 and 2, it is explicitly shown that the fixed point vector is taken as the vector which has the maximum number of 1's. In both the steps we obtain the fixed point vector as (0 1 1 0 0 1 0 0 1 1 1).That is, the factors such as 2,3,6,9,10 and 11 are the main implicated factors so for any common factors as we have taken as attributes 1 to 11, the above are the casualties.

The second interesting result we can see that the above fixed point vector is nothing but the 4th factor in the casual connection matrix M, 'Easy availability of Endosulfan'. So we can conclude that this factor as the most impactful factor in this study, even though many attribute present.

Earlier studies in this field, revealed results by concentrating one or two factors alone. But the unique contribution of this study is that various interpersonal, social, intrapersonal and empirical factors for identifying the cause of using Endosulan have been taken and among them the most impactful factor also found. Although this research is unique, it has a couple of limitations also. First the limitation of IFCM. This model consists of lengthy procedure of calculation which is not suitable for calculation with matrices which has higher number of rows and columns. Second, this manual calculation is fully based on expert's opinion. So, it may lead to personal bias. But to deal with unsupervised data, the IFCM model predicates the accurate results when comparing the FCM model. The reason is, the vector yields more number of concepts is considered to be the most vector that is, the fixed point which is not the case of FCM. The present

study is the first that examining the effects and causalities of each attribute taken for the study. Also it yields the most impactful factors for identifying the cause of using Endosulfan in agriculture fields.

6. Remdial Measures

An immediate remedial measure is to bring the awareness on the effects of Endosulfan among the farmers by the Govt. or NGO's by the following methods.

1. By supplying organic pesticides to the farmers freely.
2. Giving information of alternative pesticides through media's like newspaper, T.V., and radio.
3. By inaction road shows the most dangerous effects of Endosulfan in villages by social organizations.
4. Regular medical checkup by Govt. doctors and their advances to the farmers in not using the dangerous pesticides.

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