International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 4 Issue 05, May-2015

# Finding barriers in a Small Scale Industry using ISM Methodology

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***Abstract* - The ISM methodology is used for finding barrier in the plant. The barrier affecting the continuous flow production rate are found out by mustering the information from the employees of the firm selected and then by using Interpretive structural modeling (ISM) the most prone Cause is found and the desired suggestions are being provided. This system is not only used in large scale manufacturing industry but also in the other medium and small scale manufacturing industry. The certain barriers find out which are affecting and arising continuous flow of production in the plant, and also we tried to eliminate these barriers first by prioritizing the Barriers which is affecting the process most number of times with help of ISM.**

***Keywords:-Barriers, Production Rate, ISM.***

## I. INTRODUCTION-

ISM is of is a well established methodology for identifying relationship among specific items, which define a problem or an issue. For any complex problem under consideration, a number of factor may be related to an issue or problem. How ever the direct and indirect relationships between the the factor describe the situation far more accurately than the individual factor taken in to isolations. ISM is an interactive learning process. In these techniques, a set of different directly and indirectly related elements are structured into a comprehensive systematic model. The model so formed portrays the structure of a complex issues or a carefully designed pattern implying graphics as well as worlds.

Interpretive structural modeling is a computer-aided method for developing graphical representation of system composition and structure. ISM had its inception in Warfield's 4 perception of the need, when attempting to couple science policy, for "a set of communication tools which have both a scientific and lay character serving as a linkage mechanism between science and the public, and having meaning for all who are involved "and which in particular, are capable of communicating a holistic sense of the elements and their relations which define system structure.

ISM starts with an identification of variables, which are relevant to the problems or issue, and then extends with group problems – solving techniques. Then a contextually relevant subordinate relation is chosen. Having decided on the elements set and the Contextual relation, a structure self –interaction matrix (SSIM) is developed based on pair wise comparison of variables. In the next step, the SSIM is converted into a reachability matrix (RM) and its transitivity is checked. Once transitivity embedding is complete, a matrix model is obtained. Then the partitioning of the elements and an extraction of the structural model called ISM is derived.

In this approach, a systematic application of some elementary notions of graph theory is used in such a way that theoretical, conceptual and computation leverage are exploited to explain the complex pattern of contextual relationship among a set of variables. ISM is intended for use when desired to utilize systematic and logical thinking to approach a complex issue under consideration.

## II. LITERATURE REVIEW

The model so formed port rays the structure of a complex issues or problems in carefully designed patterns implying graphics as well as words. ISM was first proposed by by J.warfieldin 1973 to analyze the complex socioeconomic systems Yash Joshi, Satendre Parmer, Saurabh S Chandrawat develop the relationships among the identified KM barriers. The interpretive structural modelling (ISM) methodology has been used to evolve mutual relationships among these KSBs (1). Vikram Sharma & amit rai dixit analyze the barriers to implementing lean manufacturing practices based on the investigation of machine tool industry in the National Capital Region of India (2). P. Shahabadkar, S.S. Hebbal & S. Prashant has defined the concept of ISM and examines ISM as modelling technique. And use of ISM by the various researchers in their research for modeling and use of ISM for modelling in the area of Supply Chain Management (3)., Pallavi Sharma, G. Thakar, R.C. Gupta analyze the relationship among the identified various functional /technical objectives (criteria's) of assembly line balancing problem using ISM and the objectives (criteria's) depending upon their driving and dependence power (4). Pankaj Srivastav and Manoj Kumar Gaur Maximum of the small scale industries are setting up their own manufacturing plants in economical Indian market. a structural model of barriers to implement green supply chain management in north Indian small scale industry has also been place forward using Interpretive Structural Modeling (ISM) technique. To identify the barriers to implement green supply chain management in north Indian small Scale industry and to overgrown them. The structured model developed will assistance to appreciate

interdependence of the barriers. (5) Ningwei Liu, apply a computer-assisted learning process called Interpretive Structural Modeling (ISM) to construct a structural graph and illustrate those risk interrelationships. Dephi techniques can be used to "parameterize" this process according to group consensus regarding risk elements and interrelationship. (6) Surajit bag and neeraj anand develop a GSCM model for rubber goods manufacturing sector based on the result of ISM and MICMAC analysis.(7) Jacob P. George & V. R. Pramod , develop the relationship between the important barriers of SRRMs. It also helps to classify the barrier depending upon the dependence power and the driving power (8). A. Jayant, mohamd. Azhar ,priya singh provide an up-to-date and structured insight of the recent literature review relating to Interpretive Structural Modeling (ISM) and its deployment for modeling the variables of Supply Chain Management (SCM) and other related fields(9). Rajesh Attri, Nikhil Dev and Vivek Sharma find the relationships between specific items, which define a problem or an issue. This approach starts with an identification of variables, which are relevant to the problem or issue (10).

## III. PROBLEM IDENTIFICATION:

The data are collected was the "Techno Egg. & Corporation Limited " Village Salod, Near- Utai Bhilai Chhattisgarh. A manufacturing unit producing multi products like insulating sleeve, triangular chaplet, spring chill, straight bar chill, exothermic key, hot top, coil chill, head nail, straight chaplet, rectangular chaplet In this plant the production process are done at 5 to 6 steps like making the hot top and sleeve first of aluminium mixing the raw materials like waste paper, sand, fly ash, aluminum ash, starch powder, mineral wool resin powder, acids and burnt rice etc. Are mixing at the proper manner. Here the mixing process is called the batch. This is two types (1) black batch and (2) red batch. The mixing process are done through the woman worker and that are completed the mixing process in between 1to 2 hours. The second process are drying the some mixing materials and the mixer are called batch .The procedure are to pouring in the different section like different patterns. In the industry the various machine are employed the sequential basis. The various section inventory carrying section, machine section, assembly section, workshops and store room in industry are in sequences. The major barrier which are interrupted the continuous production flow rate are –

1. *Inefficient management :*
   Efficient management is one of the prior most assets that an entrepreneur can have. If at a certain point of instance he/she fails to manage, he will have to pay the cost in terms of money, quality, material loss etc. from the time of getting a plan to converting it into reality, management is required in one form or the other. As the firm of small or medium turnover is concerned and that to with a single owner who manages everything in his own, it is mandatory to manage well. In the firm Techno engineering Pvt. Ltd. A single owner manages everything from managing workers, maintaining machines and materials to monetary dealings. After the analysis of various processes performed here and the output achieved we can't say that every thing is going in a smooth flow.
2. *Finance problem :*
   For proper functioning of a firm, financial strength is a very important factor. After visiting the firm and sharing views with the workers and owner we analyzed that the firm is not financially stable to deal with any situation. Sometime when there is shortage of raw materials in the market and they have to buy it at higher price or when a machine breaks down or any other calamity happens, the firm suffers. This firm neither has any kind of government support because it is never accredited nor it has any support from any trust. It runs on its own and whenever there is a need of instant money it has to take loan from banks or other sources .
3. *Absence of organized marketing :*
   As the firm does not performs proper marketing it is not becoming a brand and if a company doesn't become a brand in 19 years, at least in its region then its matter of concern and it can be predicted that without any drastic change it would never become a brand. Expansion is need of time for a firm, and if proper marketing would not be there then it would be difficult for the firm to stand parallel to its competitor. Marketing includes advertisement, dealing distribution, stabilizing the firm in the market, tender negotiations; selling etc. marketing is a part of management where active work is needed. Without proper marketing, the dream of development can't be imagined.
4. *Irregular supply of raw materials*
   As the company is not a renowned one, some- times it doesn't get raw materials in proper time as the supplier provides raw materials to the prior companies first. It can also be a cause of unfavorable climatic conditions. Sometimes raw material is supplied but is not of standard quality that can be used. The company's primary product is insulating sleeve, which is used in the casting process in giant firms. These firms only use sleeves of a proper composition and have a set standard parameter so it is quite necessary for the firm to check the problems of irregular supply of raw materials. For a good or continuous supply of raw materials a good relationship with vendors should be maintained. So it can be implied that irregular supply of raw materials can interrupt the continuous production rate.
5. *Lake of skilled manpower :*
   Skilled manpower is one of important requirements of a firm. Techno engineering Pvt. Ltd. Is a firm dealing with mechanical applications basically casting and heat treatment processes. In these processes precision is an important aspect, which can only be applied by skilled laborers. This firm is situated in country side Selud, so it is not easy to find skilled laborers in nominal wages. Hence the owner has employed unskilled village persons and given his directions to work. So the product will not be of standard quality and this can also be the reasons of tender failure in coming days due to higher competition in future. So it can be implied that shortage of skilled

workers can be counted as a barrier in the production firm.

6. *Inadequate infrastructure*
   We have visited many firms and in one of them it was written in a board "clean place safe workplace". During our visit to Techno engineering Pvt.Ltd. we analyzed that the workplace is not of standard condition. The roof is tin-sheeted and the floor is just an unplastered, dusty and, dusty unleveled one. The machines are rusty and noisy. The electrical switches are not of good quality and the wires are improper and meshy at some places. Fans are less in number than required. Further, the workers are not using any safety tools like helmets, gloves, shoes etc. if the workers will not get good workplace they will not be enthusiastic towards their work which is a sign of degradation of the firm.
7. *Large scale completion*
   In the market there are various types of shops, we can identify that there are many shops present in the market for the same type of product. Some are big shops which sell the products in lot and the others are small shops. In the same way in front of giants firms there are number of options to select small firms as theirs vendors, due to the presence of large number of small factories indulged in making parts which are useful for giant firms. So there is a tough competition for small industries like Techno engineering Pvt. Ltd. To compete with regular winners.
8. *Burden of taxes*
   From purchasing of raw materials to distribution, and from distribution to selling at every step there are some addition amounts given by the owner in terms of taxes or transportation charges. Adding to this government interference of income tax, industrial taxes, EMIs of the loans taken from banks. These are the factors which reduce the pure gain amount and are undesirable for the growth of an industry. Hence we are considering this as a barrier and will try to solve this barrier with advanced techniques of ISM.
9. *Lack of flexibility*

   Flexibility is a characteristic by which anything can be put into work with some comfortable movements. Flexible working operations are considered better than those of static one as it provides flexible movement of the machines by providing ease during tasks. But the firm into which we are focusing, Techno engineering Pvt. Ltd. Is not applying flexibility in its firm. So its workers are getting fatigue and got tired before they should. After applying flexibility methods the firm will certainly get good results. So we are considering lack of flexibility as a barrier for the firm. Hence we will be analyzing it for its eradication through modern operational techniques.

10. *Inappropriate location*
    Location of a firm is also one of the important factors which decide its future. Remote locations can be a burden for the firm owner as most of the times it remains away from the market and the integrated cost of transportation from firm to market makes the budget higher. So it is desirable to be nearer to market so that transportation can be minimized. The firm Techno engineering Pvt. Ltd. Is situated in Selud which is 60 km from the market of Raipur which is considerable because there are many industrial locations near the market in 10 km range. We have analyzed that it is a burden for the owner to transport the finished products to the market again and again as it takes 2 hours for the delivery and huge charges of transportation. So inappropriate location is also a degrading factor for the firm and can be considered a barrier.
11. *Environment factors*
    Environment has always been a deciding factor for a firm or any industry because it makes no money, it is beyond all. If it will be in its ugly form. There are certain environment regulations under which the firm is bound to perform its work. This makes a change in the policies and even the budgeting of the firm. According to the environment in some cases to run a firms there are certain permit requirements that the firm owner has to fulfill. If it is not favorable it is a barrier for the firm.

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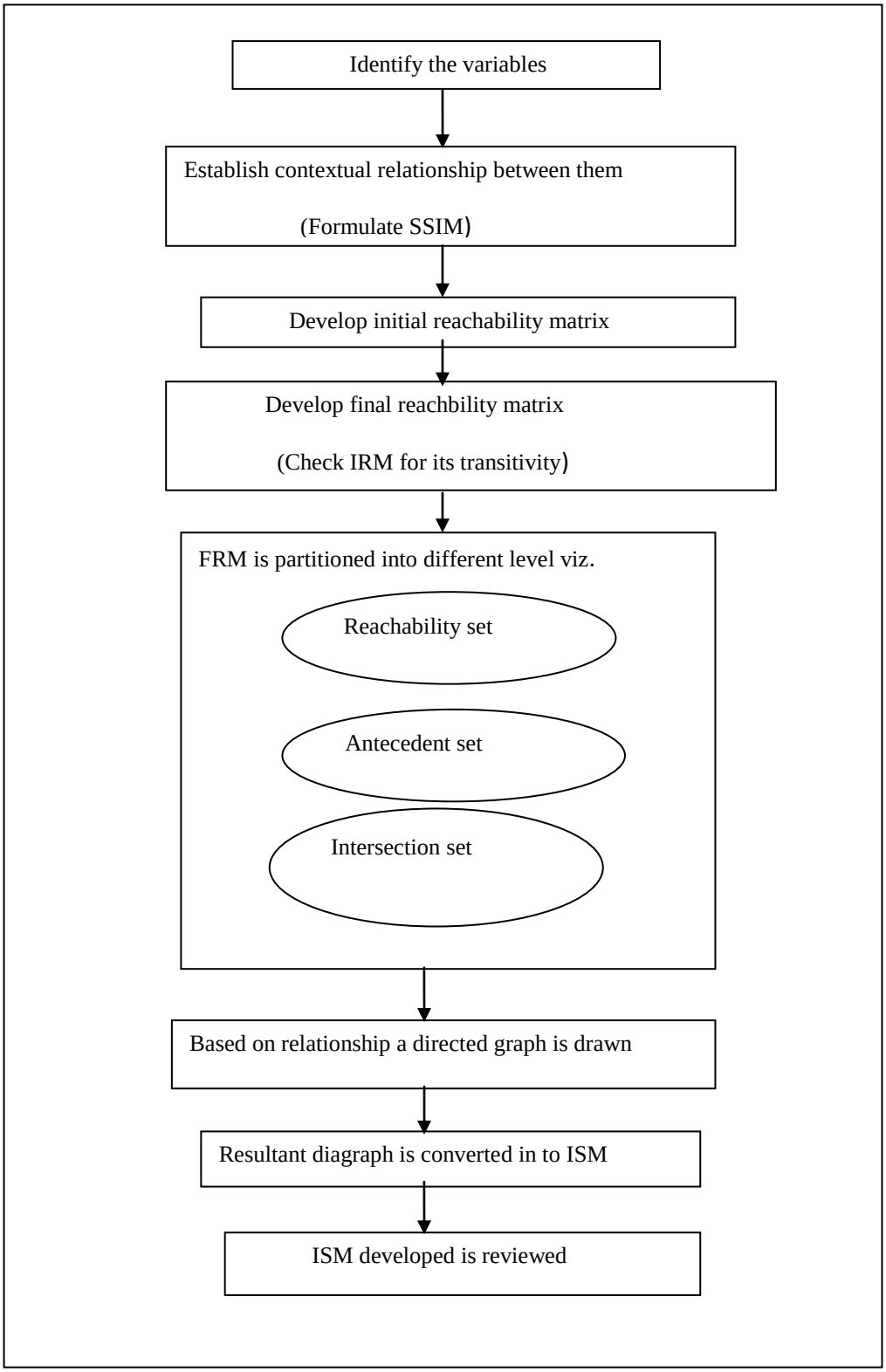
## IV. METHODOLOGY

### STEPS IN ISM



Steps are in following manner:-

1. Identify The Variables: - The first step in ISM is to indentify different variables which are related to the problem and then it spread to a complex problem solving technique.
2. Formulate SSIM: - next step in ISM is to formulate SSIM i.e. structural self- interaction matrix in which the relationship between different variables are shown by using rating system. There are four types of rating which is usually provided in ISM , they are described below :

   V: it indicates relationships between factor i to j i.e. factor I will alleviate j .

   A: it indicates relationship between factor I to j i.e. factor j will alleviate i.

   X: it indicate relationship between factor I to j i.e. both factors will depends on each other.

   O: it indicate relationship between factor I to j i.e. both factors will not depends on each others.

   On the basis of four ratings i.e. V, A, X, O are given to different variables found in the first step.

3. Develop Initial Reachability Matrix: - the rating given between different variables in the above step is now converted using binary logic .the following logic is used for conversion.
   - For rating V: the (i , j) rating will be replaced by 1and (j, i) will be replaced by 0.
   - For rating V: the (i,j) rating will be replaced by 1and (j,i) will be replaced by 1.
   - For rating V: the (i,j) rating will be replaced by 1and (j,i) will be replaced by 1.
   - For rating V: the (i,j) rating will be replaced by 1and (j,i) will be replaced by 0.

   Following the above step the initial reachability matrix is prepared.

4. Develop Final Reachability Matrix: now the matrix formed in the above step is check for its transitivity, i.e. if the variable A depends on variable B and variable B depends on variable C ,then variable A will depends on variable C .we replace the place where transitivity apply by 1T.now a new matrix is formed which is termed as final reach ability matrix.

5. Level Partitioned: now the final reachability matrix is further segregated into different levels, they are :

   - Reachability set :for any variables the reachability set includes the set of variables which are depends on it and are effected by it.
   - Antecedent set: for any variables the antecedents set includes the set of variables which are having a control over it.
   - Intersection set: it can be defined as the set of variables which are common in reachability set and antecedent set. it can also be seen as the intersection of reachability and antecedent sets .

6. A Directed Graph Is Drawn: based on the relationship between the driving power and dependence of the variable, a directed graph is drowning in order to classify the deferent variables .the directed graph is divided into four segments.
   - The first segment includes variable having low dependence and low driving power ,these are termed ass autonomous variable as these variables hardly have any effect on the variables .
   - The second segments consist of variables having high dependence and low driving power.
   - The third segment consists of variable high dependence and high driving power i.e. these have control on many variables and these variable can also control most of the variables.
   - The fourth segments includes variables which has driving power and low dependence i.e. they are not influenced by most of the variables but can control most of the variables, so these are variables which are to be eliminated first.
7. Resultant Diagraph Is Converted Into ISM: now the diagraph which is formed by using driving power and dependence of variables sis converted into ism .in this model a visual map is prepared which shows the dependency of different variables considered upon each other.
8. ISM Developed Is Reviewed: after preparing ISM, the model is reviewed for further improvement. if there is any conceptual inconsistency in the model then the model is again cheeked and steps discussed above is again applied.

   After knowing the above mentioned barriers , as we have applying ISM.We have establish relationship between these barriers using variables V,A,X,O as mentioned Above.The SSIM (Structural self-interaction matrix) is formed and as shown below

   *Characteristics of ISM:*

1. Interpretive as the judgment of group besides whether and how the different element is related.
2. Structural on the basis of mutual relationship an overall structure is extracted from the complex set of elements.
3. Modeling technique as the specific relationships and the overall structure are portrayed in diagraph model.
4. Helps to impose order in the direction on the complexity of relationship among various element of system 3, 6.
5. Primarily intend as a group learning process, but individuals can also use.

| BARRIERS | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Insufficient management | O | O | V | O | V | V | V | V | V | V | |
| Finance problem | O | O | V | A | O | O | O | V | A | | |
| Absence of organized marketing | O | O | X | A | X | O | A | V | | | |
| Irregular supply of raw materials | A | A | A | O | O | O | O | | | | |
| Lack of skilled manpower | O | A | O | O | V | O | | | | | |
| inadequate infrastructure | O | A | V | O | O | | | | | | |
| large scale competition | O | O | X | O | | | | | | | |
| Burden of taxes | A | O | A | | | | | | | | |
| Lack of flexibilities | O | A | | | | | | | | | |
| Inappropriate location | V | | | | | | | | | | |
| Environment factor | | | | | | | | | | | |

SSIM (Structural self – interaction matrix)

Now the initial reachability matrix is formed by converting the rating given to different variables. The conversion is done using binary logic. The conversion follows

For rating V: the (i,j) rating will be replaced by 1 and (j,i) will be replaced by O.

For rating V: the (i,j) rating will be replaced by O and (j,i) will be replaced by 1.

For rating V: the (i,j) rating will be replaced by 1 and (j,i) will be replaced by 1.

For rating V: the (i,j) rating will be replaced by O and (j,i) will be replaced by O .

## V. SOLUTION PROCEDURE

Initial Reachability Matrix (IRM)

| BARRIERS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 3 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 7 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 8 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 9 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 10 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |
| 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

When the IRM is formed then it checked for its transitivity which states that if B belongs to A, and C belongs to Bthe C will also belongs to A. similarly we have done using different barriers as it is required to do in ISM and then the final reachabilitity matrix is formed.$t^2$

Final Reachability Matrix (FRM)

| BARRIERS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | DRIVING |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | $1^T$ | 1 | 0 | 0 | 9 |
| 2 | 0 | 1 | $1^T$ | 1 | 0 | 0 | $1^T$ | $1^T$ | 1 | 0 | 0 | 6 |
| 3 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | $1^T$ | 1 | 0 | 0 | 6 |
| 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 5 | 0 | $1^T$ | 1 | $1^T$ | 0 | 0 | 1 | 0 | $1^T$ | 0 | 0 | 6 |
| 6 | 0 | 0 | $1^T$ | $1^T$ | 1 | 1 | $1^T$ | $1^T$ | 1 | 0 | 0 | 6 |
| 7 | 0 | $1^T$ | 1 | $1^T$ | 0 | 0 | 1 | $1^T$ | 1 | 0 | 0 | 6 |
| 8 | 0 | 1 | 1 | $1^T$ | 0 | 0 | $1^T$ | 1 | $1^T$ | 0 | 0 | 6 |
| 9 | 0 | $1^T$ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 6 |
| 10 | 0 | 0 | $1^T$ | 1 | 1 | 1 | $1^T$ | $1^T$ | 1 | 1 | 1 | 9 |
| 11 | 0 | $1^T$ | $1^T$ | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 5 |
| DEPENDENCE | 1 | 8 | 10 | 11 | 3 | 3 | 9 | 9 | 9 | 1 | 2 | |

Now when the final reachability matrix is formed then need to proceed toward the solution by finding the most prone barrier by doing the following iterations. We have divided further barriers into different levels viz.

- Reachability set
- Antecedent set
- Intersection set

$1^{St}$ iteration

| BARRIER | Reachability set | Antecedent set | Intersection set | Level |
|---|---|---|---|---|
| 1 | 1,2,3,4,5,6,7,8,9 | 1 | 1 | |
| 2 | 2,3,4,7,8,9 | 1,2,3,5,7,8,9,11 | 2,3,7,8,9 | |
| 3 | 2,3,4,7,8,9 | 1,2,3,5,6,7,8,9,10,11 | 2,3,7,8,9 | |
| 4 | 4 | 1,2,3,4,5,6,7,8,9,10,11 | 4 | $1^{st}$ |
| 5 | 2,3,4,5,7,9 | 1,5,10 | 5 | |
| 6 | 3,4,6,7,8,9 | 1,6,10, | 6 | |
| 7 | 2,3,4,7,8,9 | 1,2,3,4,5,6,7,8,9,10 | 2,3,7,8,9 | |
| 8 | 2,3,4,7,8,9 | 1,2,3,4,5,6,7,8,9,10,11 | 2,3,7,8,9 | |
| 9 | 2,3,4,7,8,9 | 1,2,3,4,5,6,7,8,9,10 | 2,3,7,8,9 | |
| 10 | 3,4,5,6,7,8,9,10,11 | 10 | 10 | |
| 11 | 2,3,4,8,11 | 10,11 | 11 | |

We find the above iteration the value of intersection set and the value of reachability

Set are equal barrier 4which means that the barrier is the one which is control by

The most and controls least number of variable. Therefore we eliminate the barrier 4 in the next step and also we have removed this barrier from further calculations

$2^{nd}$ iteration

| BARRIER | RECHABILITY SET | ANTECEDENT SET | INTERSECTION SET | LEVEL |
|---|---|---|---|---|
| 1 | 1,2,3,5,6,7,8,9 | 1 | 1 | |
| 2 | 2,3,7,8,9 | 1,2,3,5,7,8,9,11 | 2,3,7,8,9 | $2^{ND}$ |
| 3 | 2,3,7,8,9 | 1,2,3,5,6,7,8,9,10,11 | 2,3,7,8,9 | $2^{ND}$ |
| 5 | 2,3,5,7,9 | 1,5,10 | 5 | |
| 6 | 3,6,7,8,9 | 1,6,10 | 6 | |
| 7 | 2,3,7,8,9 | 1,2,3,5,6,7,8,9,10 | 2,3,7,8,9 | $2^{ND}$ |
| 8 | 2,3,7,8,9 | 1,2,3,6,7,8,9,10,11 | 2,3,7,8,9 | $2^{ND}$ |
| 9 | 2,3,7,8,9 | 1,2,3,5,6,7,8,9,10 | 2,3,7,8,9 | $2^{ND}$ |
| 10 | 3,5,6,7,8,9,10,11 | 10 | 10 | |
| 11 | 2,3,8,11 | 10,11 | 11 | |

We find that in the above iteration the value of intersection set and the value of reachability set are equal for barrier 2, 3,7,8,9 which means that the barriers are control by the most and controls least number of variables. Therefore we eliminate the barriers 2, 3,7,8,9 in the next step and also we have removed these barriers from further calculations.

$3^{rd}$ iteration

| BARRIERS | RECHABILITY SET | ANTECEDENT SET | INTERSECTION SET | LEVEL |
|---|---|---|---|---|
| 1 | 1,5 | 1 | 1 | |
| 5 | 5 | 1,5,10 | 5 | $3^{RD}$ |
| 6 | 6 | 1,6,10 | 6 | $3^{RD}$ |
| 10 | 5,6,10,11 | 10 | 10 | |
| 11 | 11 | 10,11 | 11 | $3^{RD}$ |

We have find that in the above iteration the value of intersection set and the value of reachability set are equal for barriers 5.6,11 which means that the barriers are controls by the most and controls least number of variables .

Therefore we eliminate the barriers 5,6,11 in the next step and also we have removed theses barriers from further calculations

$4^{th}$ iteration

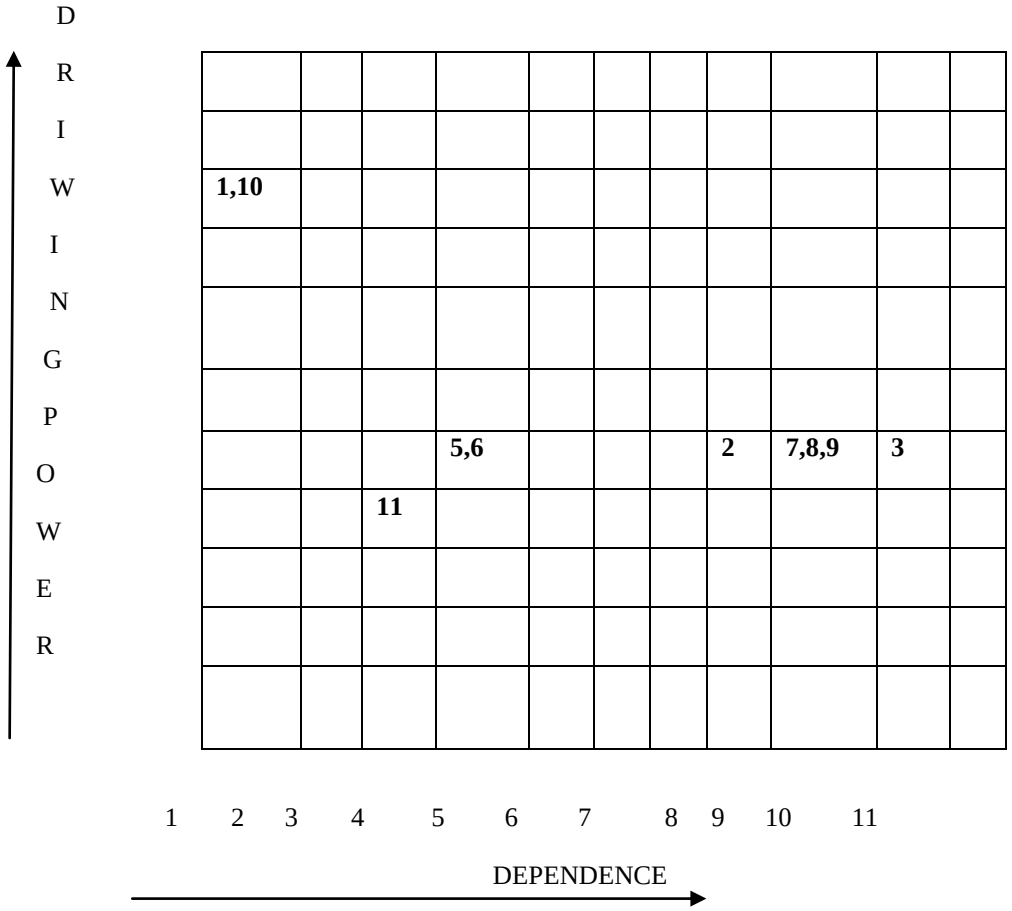
| BARRIERS | REACHABILITY SET | ANTECEDENT SET | INTERSECTION SET | LEVEL |
|---|---|---|---|---|
| 1 | 1 | 1 | 1 | $4^{TH}$ |
| 10 | 10 | 10 | 10 | $4^{TH}$ |

We find in the above iteration the value of intersection set and the value of reachability set are equal for barriers 1, 10 which means that the barriers are control by the most and controls least number of variables. After eliminating 1, 10 barriers we came to the solution and all the variables are eliminated and now the diagraph a drawn**.**

## VI. RESULT AND CONCLUSION

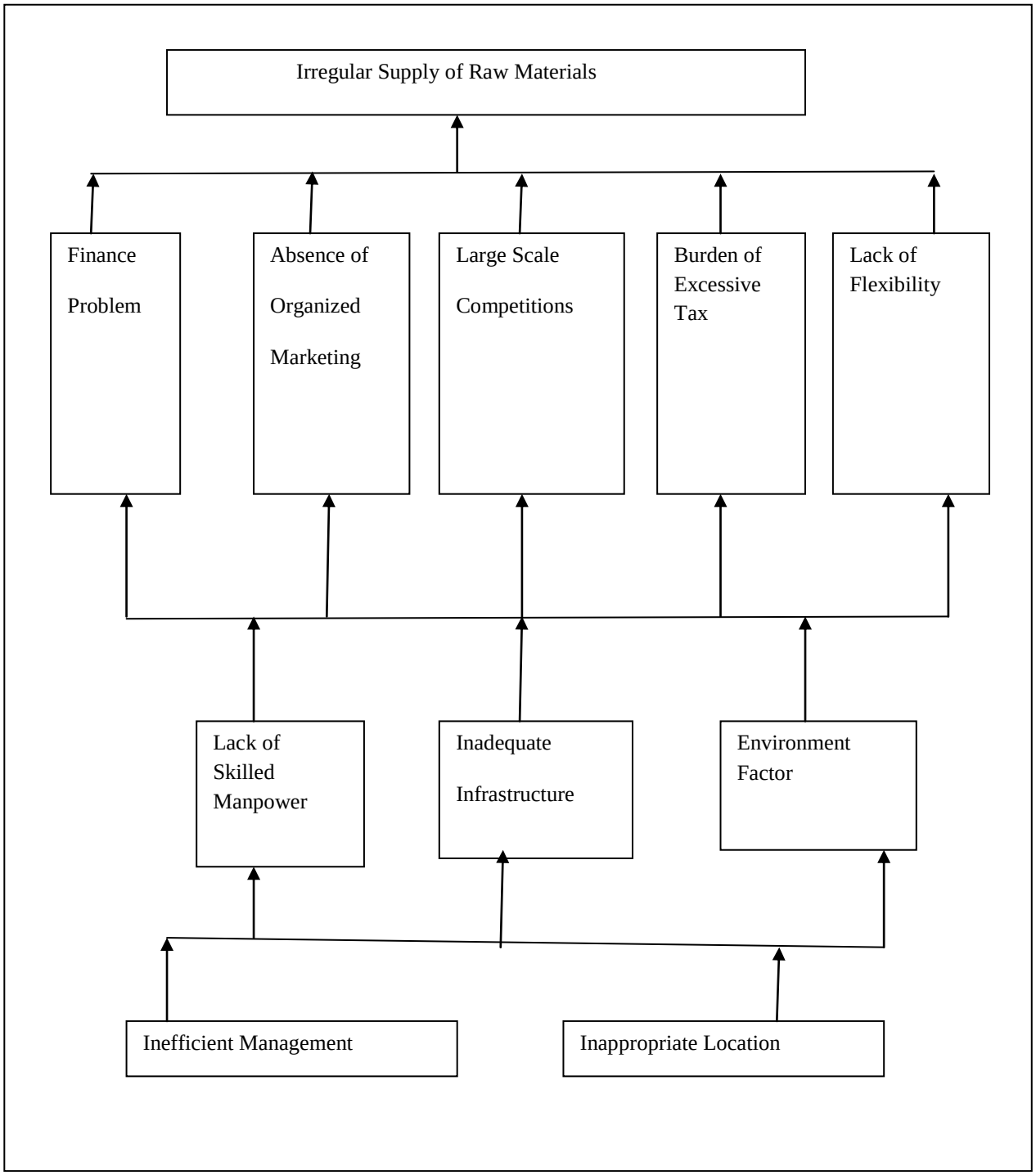
MICMAC Analysis

Now the barriers are plotted in the graph using the dependence and driving power of the variables calculated-




The graph plotted is divided into four clusters 1, 2, 3, and 4. Cluster 1 is considered as autonomous barriers that have weak dependence and weak driving power. These barriers can be removed independently and any action on these barriers will not affect other barriers. The second clusters have barriers which have strong dependence and weak driving power i.e. They are controlled by many of other barriers but they don't have control over other barriers. The third cluster consists of barriers that have strong dependence and strong driving power i.e. they are dependent on most of the barriers and also they can drive many barriers. Any action on these barriers will cause a huge effect on other barriers and also any action on other barriers will effect these barriers . the fourth cluster consists of barriers having strong driving power and low dependence i.e. these barriers can control a lot of other barriers but they are not in control of other barriers. These are the key barriers which are to be eliminated first in order to decrease the barriers coming in the way of continuous flow production.

The ISM model is thus formed and it shows the relationships between variables as obtained by us:




## CONCLUSION:-

Further by ISM method we have found the key barriers which interrupt the countinous flow production of the firm and also the suggestion is provided by us on how to overcome the barriers .in this way lean is implanted in this plant by reducing the inventory of the plant.

## REFERENCES

1. Ash Joshi, Santander Parmer, Sarah S Chandra at Sep (2012) Introduction to Modeling the Barriers, an Interpretive Structural Modeling Approach.
2. Vikram Sharma & amit rai dixit (dec 2014) analysisof barriers to lean implementation in machine tool section.
3. P. Shahabadkar, S.S. Hebbal & S. Prashant sep 2012, Deployment of ISM Methodology in SCM.
4. Pallavi Sharma, G. Thakar, R.C. Gupta Volume 83 – No 13, December 2013 develop ISM of Functional Objectives (Criteria's) of Assembly Line Balancing Problem.

5. Pankaj Srivastav and Manoj Kumar Gaur (2015) Barriers to Implement in Green SCM in Small Scale Industry using ISM Technique -A North Indian Perspective.
6. Ningwei Liu, (2007) Using Interpretive Structural Modeling to Identify and Quantify Interactive Risk.
7. Strait bag and neeraj Nov (2014) modeling green SCM framework using ISM and MICMAC analysis.
8. Jacob P. George & V. R. Pramod Vol. 2, Issue 4, Apr 2014, 161-174. An (ISM) analysis approach in STEEL RE ROLLING MILLS (SRRMs).
9. A .Jayant, Mohammad. Azhar, priya singh aprail (2015) Interpretive Structural Modeling (ISM) Approach: A State of the Art Literature Review.
10. Rajesh Attri, Nikhil Dev and Vivek Sharma Vol. 2(2), 3-8, February (2013). Interpretive Structural Modelling (ISM) approach: An Overview