Influence of Operations Management on Other Business Activities in an Organization

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Abstract:
Operations define the optimization and net profitability of any process. Being recognized for these attributes, the world is trying to understand the influence of operations management on different departments of firms. Our Paper aims at understanding this influence. Drawing response from a manufacturing firm and then using DEMATEL algorithm to understand those influences helped us to come into conclusion that operations management is responsible for increasing efficiency of organization.

1. Introduction

Operations management is defined as the art of improving processes. The main aim of Operations as a field of study is to transform a process. Requirements and feedback from customers are regularly used to adjust the transformation process, (Russell & Taylor et al., 2011) Operations can take different forms, the transformation processes can be physical (as in manufacturing) to informational (as in communications), While the term operations management conjures up views of manufacturing environments, many of these concepts have been applied in service settings, with some of them actually developed specifically for service organizations. The four primary functional areas of a firm are marketing, finance, operations and human resources. Operations is the technical hub of the different organizations, application of Just in Time (JIT),Total Quality Management (TQM), Zero Inventory Management(ZIT), Theory of constraints(TOC) has helped organizations to gain technical advantage over others. One way that businesses attempt to become more productive (i.e., making more output with same or less inputs) is to examine critically whether the operations performed by their workers add value. Businesses consider those that do not add value wasteful. Eliminating or improving such operations decreases the cost of inputs or processing, thereby increasing the value-added. For instance, a firm may discover it is producing an item much earlier than the scheduled delivery date to a customer, thus requiring the storage of the item in a warehouse until delivery. In effect, additional costs are incurred by storing the item without adding to the value of the item. Reducing storage time would reduce the transformation cost and, hence, increase the value-added.

2. Literature Review

A summary of questionnaire comprising of influence matrix was circulated to the functional heads of manufacturing firm and answered by 10 experts, then the DEMATEL (Decision making trial and evaluation laboratory) method was used to analyse the causal relationship. Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique was proposed by Fontela and Gabus at the end of 1971 to overcome many global complex problems in scientific, political, and economic by considering experts' attitudes. In practice, DEMATEL method has been applied to demonstrate the interrelations among criteria and to find aspects/criteria which play central roles in system to represent the effectiveness of them. In addition, hybrid combination models of DEMATEL with other methods have been extensively used in different fields such as airline security evaluation, e-learning assessment, and green supplier evaluation. Furthermore DEMATEL is not only used to obtain the influence levels of each element over others but also has been applied to detect complex relationships and build an impact-relation map of the criteria. Combination of DEMATEL and fuzzy logic

was proposed to divide required qualifications for enhanced promotion of the competency development of global managers which involves the vagueness of human judgments [10]. Then, these influence level values were adopted as the foundation of the normalization super matrix to specify ANP weights to obtain the relative importance. The result will aid the firms in the determination of the degree of importance of critical factors and their influences on operations of the industry.

There have been several studies on the influence of operations management on various business activities in an organization. Studies have been done on, how operations management serves as a component of organizations strategic management and how does it's related to environment. Similarly it has also been analyzed that operations management affect the functions of human resource management. Daniel I. Prajogo & Mark Goh have produced a paper where they have studied. Exclusive studies in the service sector have been done by various researchers where operation management has been established as a core entity to drive the performance of an organization.

2.1. Studies on Influence of Operations Management on Other Business Activities

There have been several studies on the influence of operations management on various business activities in an organization. Studies have been done on, how operations management serves as a component of organizations strategic management and how does it's related to environment. Similarly it has also been analyzed that operations management affect the functions of human resource management. Daniel I. Prajogo& Mark Goh have produced a paper where they have studied, how operational performances are affected by operations management activities in service organizations. Exclusive studies in the service sector have been done by various researchers where operation management has been established as a core entity to drive the performance of an organization. Below is a list of papers, where similar and related work has been done as our topic of discussion in this paper.

Author's Name	Title of Paper
Petra Horváthová+, Marcela Davidová	Operations Management as Practice of Organizations' Strategic Management in Relation to the Environment.
John W. Boudreau	On the Interface Between Operations and Human Resources Management
Daniel I. Prajogo & Mark Goh	Impact of operations management activities on Operational performance in service Organisations
Christine M Wright, George Mechling	The importance of operations management problems in service organizations
Benjamin Lev, WenjingShen	Contemporary research in Operations Management
Deborah L. Kellogg · Winter Nie	A Framework for Strategic Service Management
Mark Barratt, Thomas Y. Choi, Mei Li	Qualitative case studies in operations management: Trends, research outcomes, and future research implications
Elisa Battistoni1, Andrea Bonacelli, Andrea Fronzetti Colladon and Massimiliano M. Schiraldi	An Analysis of the Effect of Operations Management Practices on Performance

Table 1: List of previous Papers on influence of operations Management in other functions of firms

2.2. Studies on DEMATEL Methodology and its Applications

As discussed above DEMATEL methodology is quite helpful in decision making. It has a wide area of application. Following papers present a wide scope for knowing the methodology and its applications. Findings from the analysis of these papers, have been used in the analysis of the current topic in this case.

Author	Title of Paper
Detcharat Sumrit and Pongpun Anuntavoranich	Using DEMATEL Method to Analyze the Causal Relations on Technological Innovation Capability Evaluation Factors in Thai Technology-Based Firms
➢ Jiunn-I Shieh , Hsin-Hung Wu, Kuan-Kai Huang	A DEMATEL method in identifying key success factors of hospital service quality
➢ Elham Falatoonitoosi, Shamsuddin Ahmed and Shahryar Sorooshian	*Expanded DEMATEL for Determining Cause and Effect Group in Bidirectional Relations*
Chia-Wei Hsu , Tsai-Chi Kuo , Sheng-Hung Chen , Allen H. Hu	Using DEMATEL to develop a carbon management model of supplier selection in green supply chain management
Jianmin Hou , Dequn Zhou	Study on Influence Factors of Distributed Energy System Based on DEMATEL and ISM

Table 2: List of key Papers based on DEMATEL method

Literature is thoroughly studied for this paper and research papers which are relevant to this study from past years are cited. From the past papers, various methods of analysis, scope and functionalities related to "Influence of operations management" and DEMATEL methodology have been derived. These findings have been used in the current paper for a better analysis of the discussed topic. From the literature review of this paper, it's quite evident that, the analysis presented in this paper along with the methodology adopted can be utilized further to study the importance of operation management in various organizations. Similarly for using DEMATEL as an analysis and decision making tool, this paper cab taken as a reference.

2.3. Objectives of Writing Case
The objective of writing the case is to study and analyse "Influence of operations management on other business activities in an organization". The result found from the analysis can be utilized to improve the productivity of the organization.
Operation management is the management of all the processes and operations which convert input into goods and services. But operation management department can't work alone. It is supported by various business activities through departments like "finance","marketing","HR","IT" and other departments.
Finance brings and manages the financial resources needed for operational activities to be carried out. Hence the degree of operation affects financial activities. Marketing department play deterministic role in selling of the produced goods and services. Selling of goods and services depends on the quality standards adhered and features implemented during production activity. So operation bears its effect on marketing. Similarly HR department manages human resources. The required skill set and aptitude of the human resource to be deployed depends on the type of operation being carried out. The utilization and development of skill of the deployed human resource, which leads to employee satisfaction, is done through the operational activity in which he/she is involved. Hence operation affects the human resource management activity of the organization. IT department takes care of all the software implemented in operation processes. So the scale of operation and technologies implemented in operation activities impact IT department of the organization.
Again all the departments are also closely related to each other to perform as an integrated business unit. This dependency is also influenced by operational activities.
Hence while doing case analysis the focus will be on following objectives.
1. Influence of different business activities on organization.
2. Inter dependency of these business activities.
3. Influence of operations management on the organization.
4. Influence of operations management on other business activities of the organization.

2.4. Problem Identification
- Though it is known that the business activities of an organization influence each other, but finding the exact percentage of influence is challenging.
- The data collected from different strategic persons of a firm may vary from each other as the percentage of influence of one activity on the other is determined by them on the basis of personal observation only. This will bring high degree of variance between different data sets collected.
- Determination of ideal sample size of industry people, from which data is to be collected is quite challenging. Again selection of appropriate personal who has knowledge about all the activities of a firm requires proper knowledge about the profile of the person.

2.5. Method to Solve the Problem
DEMATEL methodology has been adopted to do the case analysis

2.5.1. DEMATEL
This problem is about the finding the influence among different departments in an organization. Dematel has been widely used for building and analysing a structural model for analysing the influence relation among complex criteria. The results obtained by Dematel method might provide insight for outreach personnel to improve performance. It shows the interdependency among the elements of organization.
DEMATEL (Decision making Trial and Evaluation Laboratory) method, was developed by science and human affairs program of the Battelle memorial institute of Geneva between 1971 and 1976.
Procedure:
There are 4 steps
1. Calculate the influence matrix
2. Calculate the normalized initial direct indirect influence matrix
3. Derive the total relation matrix
4. Set a threshold value and obtain the impact relations map

> Step 1.

Dematel uses an influence matrix to mark the degree of influence among different departments in an organization. Influence is evaluated between two departments by an integer score ranging from 0(no influence), 1(low influence), 2(medium influence), 3(high influence). The notation x_{ij} indicates the dependency of ith element on j^{th} element of matrix. When i=j, diagonal entry, dependency is set to zero. An n x n non negative matrix is constructed as $X^k=[x^k_{ij}]$, where k is the expert number of participating in evaluation process with $l<=k<=m$. Thus, X1 , X2 , X3 ,.., Xm are the matrices from m experts. To aggregate all judgments from m experts, the average matrix Z= $[z_{ij}]$ is

$Zij = (1/m)\sum_{i=1}^{m} xkij$

> Step 2.

Normalized initial direct indirect relation matrix D is calculated. Each element in matrix D is ranged between zero and one. D= A * Z, where A = Min[1/(max $1<=i<=n$ $\sum_{j=1}^{n} zij$) , 1/(max $1<=i<=n$ $\sum_{j=1}^{n} zij$)]

> Step 3.

After normalized matrix, we calculate the total relation matrix.

The total relation matrix T is defined as **T= D(I-D)$^{-1}$**, the element of t_{ij} indicates the indirect influence that element i has on element j, then the matrix T reflects the total relationship between each pair of organization. Let vector r be sum of rows and vector c be sum of columns of total relation matrix. Let r_i be the sum of ith row in matrix T, then r_i summarizes both direct and indirect influence of i on the other factors. Let c_j be the sum of jth column in matrix T, then c_j shows both direct and indirect influence of factor j from the other factors. When j=i, the sum $(r_i + c_j)$ shows the total effects given and received by element i. That is, $(r_i + c_j)$ indicates the degree of importance that factor i plays in the entire system.

> Step 4.

Since matrix T provides information on how one factor influences another, a decision maker should set up a threshold value to filter out some negligible influences .Only the influences greater than the threshold value would be chosen and shown. In this study, the threshold value is set up by computing the average of the elements in matrix T.
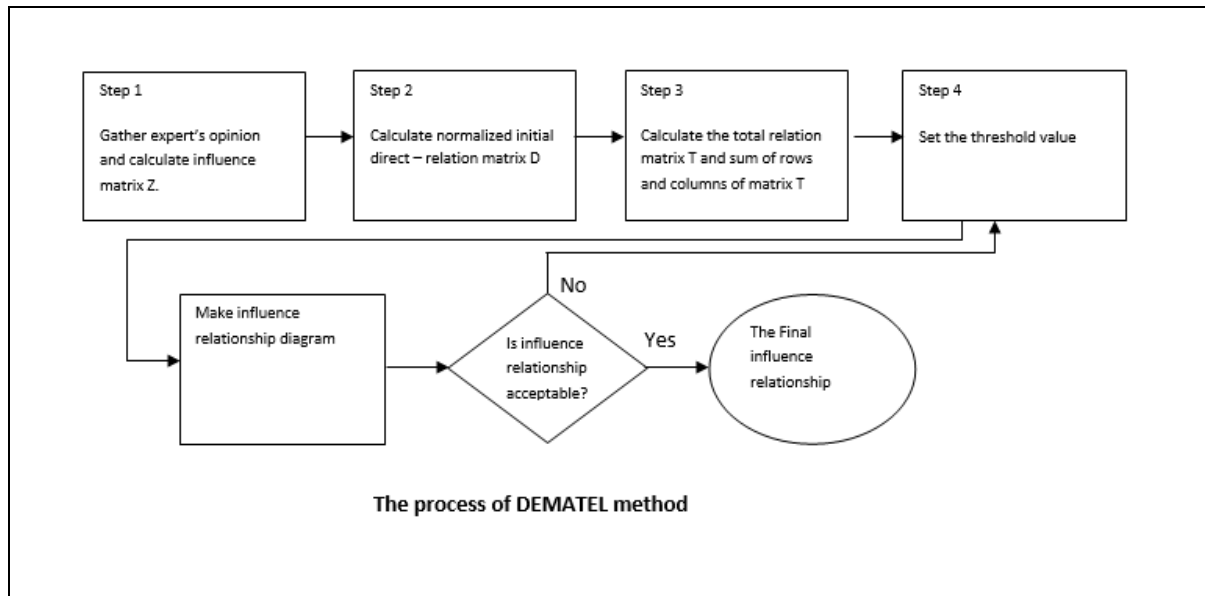

Figure 1

2.6. Brief Details of Case Organization

ABC company was established in 1974.It is one of the leading specialists in drive & control technology and supplies made-to-order solutions for driving, controlling and moving. It is a partner for industrial and factory automation, machinery and mobile applications; thus a supplier choice of customers for high quality hydraulic, electric drives and controls, linear motion and assembly technology components and systems.

ABC company manufactures Hydraulic valves, blocks, cylinders and power units at Ahmedabad and has a customized unit in Bengaluru with wide spread Sales and Service offices. It has dealer's network all over India. The company offers its customers drive and control technologies such as Mobile Hydraulics, Industrial Hydraulics, Linear Motion and Assembly Technology, Electric Drives and Controls. Products of the Company are mainly used in steel plants, machine tools, energy technology, foundry technology, plastic machinery, presses, civil engineering, materials handling, marine, ship lifts, transfer systems, offshore applications and in special technologies.

The company is accredited to ISO 9001:2008, ISO 14001:2004, OHSAS18001:2007 certification. Company has more than 1000 employee and its sales in 2014 was Rs. 7260 Million.

2.7. Solution-DEMATEL Analysis on Industry Data

Direct influence matrices with the help of expert views:

Influence of departments	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistic
Human Resource Department	0	4	4	4	4	4	4	4
Production Department	3	0	3	4	3	4	4	4
Finance Department	4	3	0	4	4	4	4	4
Application Department	2	4	3	0	4	4	2	3
Sales and Marketing Department	3	4	4	4	0	4	2	4
Quality Department	3	4	3	4	4	0	3	4
Maintenance Department	2	4	2	2	2	4	0	3
Logistic	2	4	3	3	4	4	3	0

Table 3

Influence of departments upon each other	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistic
Human Resource Department	0	1	3	1	1	0	0	1
Production Department	2	0	1	2	4	4	4	4
Finance Department	2	0	0	0	3	0	0	2
Application Department	0	2	0	0	4	3	0	2
Sales and Marketing Department	0	3	2	4	0	3	0	3
Quality Department	1	4	0	2	2	0	1	1
Maintenance Department	0	2	0	0	0	1	0	1
Logistic	0	4	2	1	3	1	0	0

Table 4

Influence of departments upon each other	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistics
Human Resource Department	0	0	3	0	0	0	0	0
Production Department	1	0	0	1	4	4	4	4
Finance Department	2	0	0	0	3	0	0	2
Application Department	0	2	0	0	4	3	0	2
Sales and Marketing Department	0	3	2	4	0	3	0	2
Quality Department	0	4	0	2	2	0	0	2
Maintenance Department	0	2	0	0	0	1	0	2
Logistics	0	4	2	1	3	2	0	0

Table 5

Calculation of average matrix:

Average matrix Z= [z_{ij}] is $Z_{ij} = (1/m)\sum_{i=1}^{m} xij^k$

Influence of departments upon each other	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistic
Human Resource Department	0	1.666667	3.333333	1.666667	1.666667	1.333333	1.333333	1.666667
Production Department	2	0	1.333333	2.333333	3.666667	4	4	4
Finance Department	2.666667	1	0	1.333333	3.333333	1.333333	1.333333	2.666667
Application Department	0.666667	2.666667	1	0	4	3.333333	0.666667	2.333333
Sales and Marketing Department	1	3.333333	2.666667	4	0	3.333333	0.666667	3
Quality Department	1.333333	4	1	2.666667	2.666667	0	1.333333	2.333333
Maintenance Department	0.666667	2.666667	0.666667	0.666667	0.666667	2	0	2
Logistics	0.666667	4	2.333333	1.666667	3.333333	2.333333	1	0

Table 6

Calculation of normalized initial direct-relation matrix:

D= A * Z,
Where A = Min [1/ (max 1<=i<=n $\sum_{j=1}^{n}$ zij) , 1/(max 1<=i<=n $\sum_{j=1}^{n}$ zij)]
After calculation with the given data A=0.051725

Influence of departments	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistic
Human Resource Department	0	0.078125	0.15625	0.078125	0.078125	0.0625	0.0625	0.078125
Production Department	0.09375	0	0.0625	0.109375	0.171875	0.1875	0.1875	0.1875
Finance Department	0.125	0.046875	0	0.0625	0.15625	0.0625	0.0625	0.125
Application Department	0.03125	0.125	0.046875	0	0.1875	0.15625	0.03125	0.109375
Sales and Marketing Department	0.046875	0.15625	0.125	0.1875	0	0.15625	0.03125	0.140625
Quality Department	0.0625	0.1875	0.046875	0.125	0.125	0	0.0625	0.109375
Maintenance Department	0.03125	0.125	0.03125	0.03125	0.03125	0.09375	0	0.09375
Logistics	0.03125	0.1875	0.109375	0.078125	0.15625	0.109375	0.046875	0

Table 7

CALCULATION OF TOTAL RELATION MATRIX:

Total matrix $T = D (I-D)^{-1}$

➤ **I - D**

Influence of departments	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistics
Human Resource Department	1	0.078125	0.15625	0.078125	0.078125	0.0625	0.0625	0.078125
Production Department	0.09375	1	0.0625	0.109375	0.171875	0.1875	0.1875	0.1875
Finance Department	0.125	0.046875	1	0.0625	0.15625	0.0625	0.0625	0.125
Application Department	0.03125	0.125	0.046875	1	0.1875	0.15625	0.03125	0.109375
Sales and Marketing Department	0.046875	0.15625	0.125	0.1875	1	0.15625	0.03125	0.140625
Quality Department	0.0625	0.1875	0.046875	0.125	0.125	1	0.0625	0.109375
Maintenance Department	0.03125	0.125	0.03125	0.03125	0.03125	0.09375	1	0.09375
Logistics	0.03125	0.1875	0.109375	0.078125	0.15625	0.109375	0.046875	1

Table 8

➢ $(I-D)^{-1}$

Influence of departments	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistics
Human Resource Department	1.029526	-0.04541	-0.14527	-0.05342	-0.0296	-0.0259	-0.0408	-0.03709
Production Department	-0.07595	1.109477	-0.01094	-0.0564	-0.12661	-0.14122	-0.18129	-0.14431
Finance Department	-0.11941	0.01177	1.048613	-0.02079	-0.13347	-0.02103	-0.04965	-0.09596
Application Department	-0.00798	-0.07163	-0.01132	1.058925	-0.1588	-0.11864	-0.00304	-0.06476
Sales and Marketing Department	-0.0135	-0.10828	-0.10553	-0.16542	1.094539	-0.10846	0.00972	-0.09033
Quality Department	-0.04124	-0.15904	-0.01286	-0.09288	-0.07347	1.068075	-0.02558	-0.05928
Maintenance Department	-0.0147	-0.1018	-0.01369	-0.00686	0.009043	-0.0685	1.028238	-0.06748
Logistics	0.00306	-0.16321	-0.08868	-0.03188	-0.11174	-0.05781	-0.00599	1.067533

Table 9

➢ TOTAL MATRIX $T=D (1-D)^{-1}$

Influence of departments	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistic
Human Resource Department	-0.02953	0.045408	0.145275	0.053425	0.029603	0.025896	0.0408	0.037095
Production Department	0.075948	-0.10948	0.010937	0.056401	0.126607	0.141222	0.181287	0.144312
Finance Department	0.119409	-0.01177	-0.04861	0.020795	0.133467	0.021029	0.049649	0.095957
Application Department	0.007983	0.071632	0.011324	-0.05893	0.158801	0.118639	0.003041	0.064757
Sales and Marketing Department	0.013497	0.108285	0.105527	0.165422	-0.09454	0.108464	-0.00972	0.090326
Quality Department	0.041239	0.159037	0.012862	0.092883	0.073465	-0.06807	0.025577	0.059284
Maintenance Department	0.014697	0.1018	0.013691	0.006856	-0.00904	0.068497	-0.02824	0.06748
Logistic	-0.00306	0.163213	0.08868	0.031882	0.111742	0.057805	0.005986	-0.06753

Table 10

ROW VECTOR r_i represents sum of ith row in total influence matrix which indicates the total given effect.
COLUMN VECTOR c_j represents sum of jth column in total influence matrix which indicates the total received effect.

(r_i-c_j) represents the net contribution and (r_i+c_j) represents the total effects given and received.

DEPARTMENTS	Column vector (c)	Row vector(r)	r+c	r-c
Human Resource Department	0.240187	0.347975	0.588162	0.10779
Production Department	0.528128	0.627236	1.155364	0.09911
Finance Department	0.339682	0.379924	0.719606	0.04024
Application Department	0.368738	0.377251	0.745989	0.00851
Sales and Marketing Department	0.530104	0.487261	1.017364	-0.042843
Quality Department	0.473477	0.396273	0.86975	-0.077205
Maintenance Department	0.268381	0.23574	0.504121	-0.032641
Logistics	0.491677	0.388715	0.880392	-0.102962

Table 11

Calculation of Threshold value (α):

It is computed by the average of the elements in total matrix.

$$\alpha = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} [tij]}{N}$$

Calculate value α=0.0506

Values higher than threshold value in total influence matrix are marked with *.
'*' marked elements show affected departments (columns) by the department of the respective row.

Influence of departments	Human Resource Department	Production Department	Finance Department	Application Department	Sales and Marketing Department	Quality Department	Maintenance Department	Logistic
Human Resource Department	-0.02953	0.045408	0.145275*	0.053425*	0.029603	0.025896	0.0408	0.037095
Production Department	0.075948*	-0.10948	0.010937	0.056401*	0.126607*	0.141222*	0.181287*	0.144312*
Finance Department	0.119409*	-0.01177	-0.04861	0.020795	0.133467*	0.021029	0.049649	0.095957*
Application Department	0.007983	0.071632*	0.011324	-0.05893	0.158801*	0.118639*	0.003041	0.064757*
Sales and Marketing Department	0.013497	0.108285*	0.105527*	0.165422*	-0.09454	0.108464*	-0.00972	0.090326*
Quality Department	0.041239	0.159037*	0.012862	0.092883*	0.073465*	-0.06807	0.025577	0.059284*
Maintenance Department	0.014697	0.1018*	0.013691	0.006856	-0.00904	0.068497*	-0.02824	0.06748*
Logistic	-0.00306	0.163213*	0.08868*	0.031882	0.111742*	0.057805*	0.005986	-0.06753

Table 12

r+c (intensity) – x axis and r-c(influence) – y axis -plot diagram for all the departments shown below.
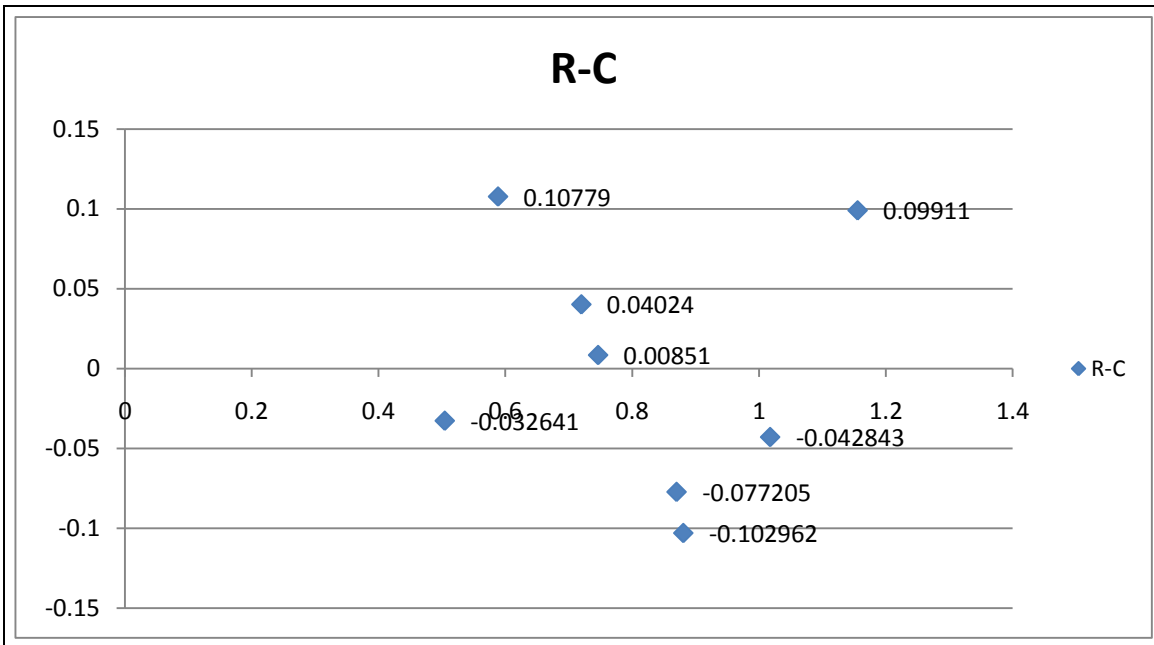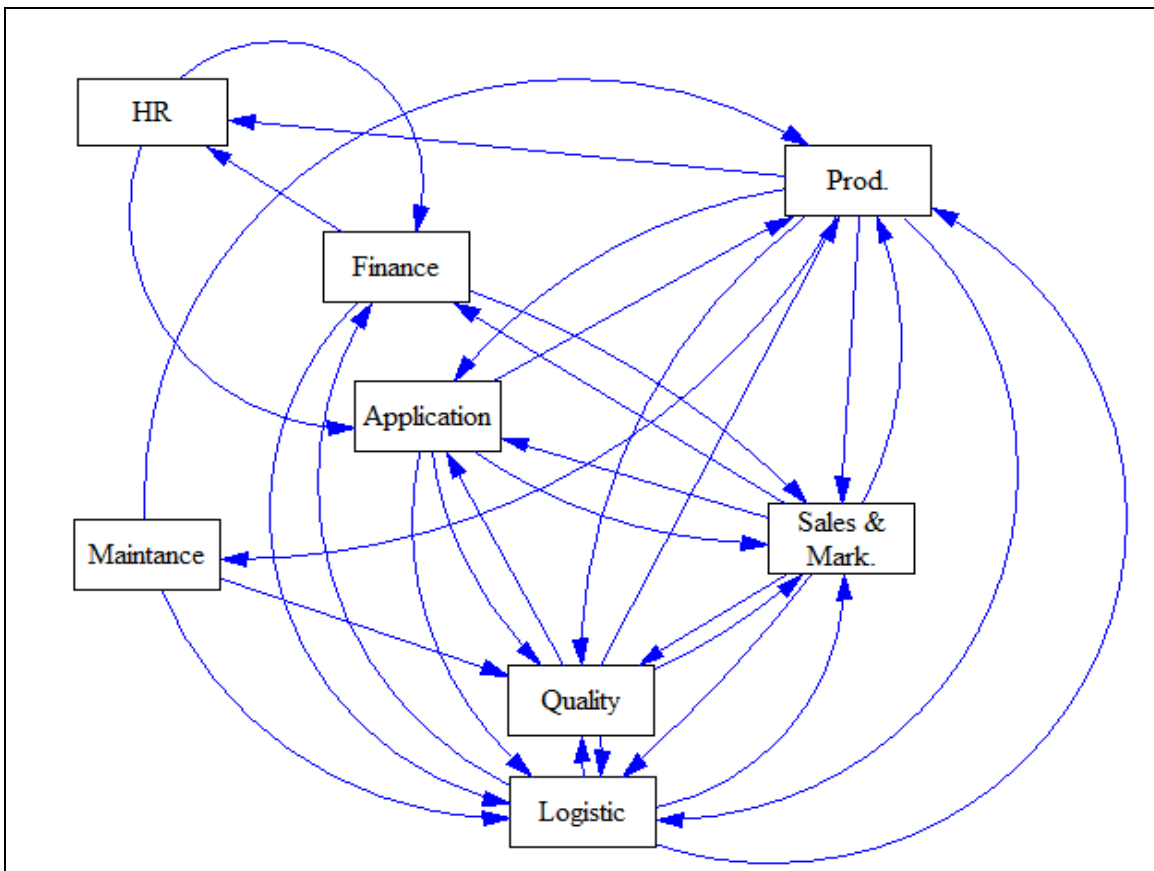
Figure 2

Figure 3: Cause and Effect Diagram

3. Conclusion and Future Scope

The cause and effect relationship depicts the stronger influence of production on all the departments of the studied organisation. This can be attributed to the changing industries scenario which generally focusses on concurrent engineering. Operations being an integral part of production influences others. Changing industry trends focus on reducing manufacturing lead time, aim at reducing inventory with profit maximization.

It can be clearly depicted from the study done above that logistics is being influenced by majority of departments. This is obvious from the fact that, logistics assists all the departments by helping in functions like transportation of goods, procurement of raw materials etc. Hence functioning of all the departments has a direct bearing on the logistics department.

From the cause and effect relationship diagram, it's also evident that every department depends on every other department for the smooth functioning of the organization. Hence care must be taken to ensure proper communication and coordination between these departments.

In the case, where we have scarcity of resources and we need to assign priorities to the departments for allocating the resources, we can assign the same in a decreasing order from the most affecting to the least affecting department.

The results obtained from the analysis presented in this paper, can be used as a reference for future studies on organisations functions. These analysis can be done on many organisations spanning across various sectors and then from the results derived, a comparative study can be done.

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