

An Empirical Study of the Supply Chain Effectiveness in Service Industries: An AHP Approach

¹RP Ajitab, ²Aishwarya Dash, ³Dr. Sushanta Tripathy, ⁴Trupti Ranjan Mahapatra

¹School of Management Studies, IGNOU, KIIT Study Center, Bhubaneswar, India

²Dept. of Mechanical Engineering, CET, Bhubaneswar, Odisha, India

^{3,4}School of Mechanical Engineering, KIIT University, Bhubaneswar, Odisha, India

Abstract

A supply chain (SC) is a network of facilities that procure raw materials, transform them into intermediate goods and then final products, and deliver the products to customers through a distribution system. It is well known that, to manage the SC in service sector is comparatively difficult than the manufacturing sector due to intangible characteristics associated with it. In this paper, we have selected two dominating service sectors namely, telecom sector and medical or health care sector and determined their effectiveness using AHP (Analytical Hierarchy Process). The various factors affecting SC management, their contribution to SC and their respective priorities have been critically investigated. The significant factors those need to be taken care appropriately of for any progressive service sectors are provided.

Keywords

Supply Chain, Telecom Sector, Medical Sector, AHP.

I. Introduction

There is no commonly accepted definition of supply chain (SC) management - it means many different things to many different people and numerous, overlapping definitions exist for it. The SC is the combination of all parties (e.g. external suppliers, partner organizations, internal corporate services units) both inside and outside the associations involved in delivering the inputs, outputs or outcomes that will meet a specified public sector requirement. SCs and their associated management processes often remain invisible to the public sector client. Government has traditionally focused on the contracting process with first tier suppliers – the SC members with whom the procuring organization directly contracts. This paper presents its definition that sets the concepts within the specific context of service industry.

There are a number of clear benefits to contracting authorities of improved efficiency and transparency in the management of service sector SCs:

Better risk allocation: In an increasingly complex delivery landscape, effective risk allocation is a critical consideration in procurement. Risk should always be allocated according to the party best placed to manage it, and a better understanding of the way in which the requirement can be delivered allows the authority to assess how risk can be allocated across the SC and how they can be managed most effectively.

Greater visibility of subcontracting opportunities for a diverse range of organizations who can bring increased competition, dynamism and particular skills or strengths to the service sector, including organizations such as SMEs, women-owned businesses and social enterprises. This can increase competition and allow organizations with particular skills or strengths to get involved in the service sector marketplace.

Greater opportunities for innovation: Supplier innovation in the SC can contribute to better quality, faster delivery and reduced whole life costs. Effective SCM offers strong potential for innovation to be released through the SC.

Better-defined requirements through early SC involvement in the shaping of the business need. The case for early SC involvement is likely to be stronger in output or outcome-based approaches or where the requirement is complex or innovative. Involvement of the SC at an early stage can be vital in establishing the right requirements and the approach to meeting them.

Therefore, the objective of the paper is to find the factors affecting the effectiveness of SC in the selected service sectors and the sub objectives have been set as follows:

- Understanding the basics of SC Management of Service industries and to determine strong variables affecting SC of Service industries.
- Framing the basic A.H.P. model of Service industries based upon the prominent variables.
- To find the priorities of all the strong variables by considering the opinions given by concerned people in questionnaire.
- Finding the service industry having the best SC effectiveness

II. Literature Review

Many attempts are already made in past to find out the different factors those affect the service sectors. Few of the important and related researches have been extracted from the available literature and presented in Table 1.

Table 1: Review of Past Works (Focus and Findings)

Drzymalski J. [1] (2012) reviewed SC framework for different service sectors and compared with manufacturing sectors. So growth in manufacturing firms due to SC management techniques can be incorporated into service sectors. They observed that, to operate service industries at optimum level further exploration and work needed.
Sampson S. E. [2] (2000) studied the Customer-Supplier duality and suggested that the duality can be achieved through Communication, partnering and customer supplier development and benefits in bidirectional SC that couldn't be achieved in traditional one are JIT delivery, better information flow.
Gopal Krishnan G. [3] (2015) proposed SC in RMIT University. In their work they have adopted SC Operation Reference (SCOR) as a decision making tool which further analyzed how to award dual certificate to students from RMIT by considering all the internal and external factors through its managerial process to establish a robust SC.

Yap L. L. and Tan C. L. [4] (2012) reported the SC management practice in Malaysia Public Health Care to provide quality service. The Information Technology Management, Demand Management, Customer relationship management, supplier relationship management, capacity and resource management are found to be the important factors for better service. Among these, the Information Technology developed Alliance Integrated Network to promote collaboration between service and products.

Kathawala Y. and Abdou K. [5] (2003) studied the failures of financial service industry (auditing, accounting and consulting) in its move towards globalization due to inefficient methods and proposed SC strategy used as solution. They compared both manufacturing and service industries and SC strategy are redefined and applied manufacturing industries.

Odoom C. K. [6] (2012) tried to achieve competitive advantage of cost saving and better facility logistics and SC activities in Hilton hotel are grouped into three different levels. It is seen, based on the different levels if activities executed in a proper way with respect to changing environment goal can be achieved.

Shkliar K. [7] (2013) analyzed the effect of Upper bound limited workload and lean based balanced workload models in service industries. They observed that both models are effective in eliminating waste and making the SC more flexible with satisfied customers.

Shing C. K. et al [8] (2013) discussed the journey of Malaysian service sector towards sustainability. They reported that the service sectors can be easily sustainable through the use of tried and tested SC strategies and technologies used in manufacturing firms. Also, the developed technology helps in accessing information seamlessly.

Gou J. et al [9] (2013) used the Fuzzy AHP to evaluate performance of service oriented catering SC and presented performance evaluation model which guarantees safety, quality at low cost.

Sakuja S. and Jain V. [10] (2012) analyzed the collaboration of different service operations of different organizations to satisfy customers. The basic model is constructed which consists of different elements and various decision criteria which can easily fit in the service SC so that performance can be optimized.

Based on the brief review it is understood that there are a variety of factors affecting SC in service industries. However, depending upon the industries to be surveyed and pilot testing we have sort-listed ten numbers of factors al listed below:

- Information within Organization on Product Orders.
- Forecasting for Orders.
- Continuous Up-gradation.
- Advertisement for Marketing.
- Coordination between Supply and Marketing.
- Prices of Services Offered.
- Schemes affecting Customer's Value.
- Promotion Advertisements.
- Understanding Customer Values.
- Adherence to Customer Grievances.

III. Methodology

The steps of research methodology are as follows.

1. Prepared rough questionnaire and then refine it based on the feedback given by 32 experts from academics, retail sectors, health sectors banking sectors, telecom sectors, and insurance sectors.
2. Took the opinions of concerned people about the relative importance of factors affecting the SC as listed in Questionnaire by personal visit.
3. Collected the score of variables listed in the questionnaire by the concerned people.
4. Analyzed the data to determine the relative effectiveness of SC being followed.
5. Listed out the important five variables affecting SC in relative sector by "Brainstorming Session". Based upon the brain storming session and opinion of concerned people we got following top five variables out of the above ten:
 - (a). Understanding Customer Value.
 - (b). Coordination between Supply and Marketing.
 - (c). Continuous Upgradation.
 - (d). Schemes Affecting Customer Values.
 - (e). Adherence to Customer Grievances.
 - Determine the relative priorities of all top five variables with the help of AHP technique.
 - Compared the priorities and figure out the best factor affecting SC management in concerned servicing industries.
 - Figured out best SC management for servicing industries of the following details:
 - (i). Bhubaneswar, Odisha: - Five (5) Medical Colleges - Sample Size = 32.
 - (ii). Bhubaneswar, Odisha: - Six (6) Telecom Service Sectors - Sample Size = 37.

IV. The Analytic Hierarchy Process (AHP)

AHP allows decision makers to model a complex problem in a hierarchical structure (Fig. 1).

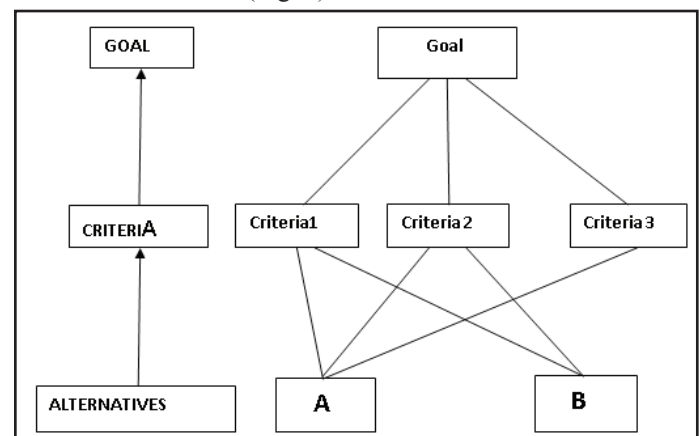


Fig. 1: Basic AHP Model

In this method, a simple hierarchical model consists of a goal, criteria and alternatives. In fig. 1, the hierarchical structure shows the relationships of the goal, criteria and alternatives from the top to the bottom. AHP copes with using original data, experience and intuition in the same model in a logical and through way. AHP is composed of several previously existing but unassociated concepts and techniques, such as hierarchical structuring, pairwise comparisons and consistency considerations. According to Saaty (2008) [11], this method has three phases: decomposition, comparative judgment and synthesizing.

V. Case Study in the Telecom Sector and the Medical Sector

In the present research, two major service sector providing service continuously on daily-bases throughout the world have been considered for analysis purpose. On the basis of the survey, different people gave their opinions (Scale used: 1-Strongly Disagree, 2-Disagree, 3-Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree) on the following 5 points namely, understanding customer value, coordination between supply and marketing, continuous up gradation, schemes affecting customer values and adherence to customer grievances. The relative contributions for each of the points have been discussed and useful conclusions are drawn.

A. Telecom Sector

It is well known that, the telecommunications sector is subject to incredible competitive pressures those drive the need to generate new revenue opportunities, add new subscribers, and increase customer retention and loyalty. These demands require a means of integration that protects existing investments in applications and that is flexible enough to support the delivery of new services. Hence the need for software services within the telecom sector has been steadily increasing over the years, especially with the demand for telecommunication services.

In a crowded market, telecommunication companies remain competitive by moving with efficiency and speed. Our solutions will provide telecommunications companies the ability to more easily manage, synchronize and coordinate sales, marketing and customer service data and embody industry’s best practices for data management.

The relative contributions for each of the points are presented in Figures 2-6.

B. Medical Sector

Similar to the telecom sector, the medical or health care sector is also known to be one of the largest service sectors providing services to millions of people daily all round the world. It includes the services of all doctors, nurses and other allied servicemen. They provide intangible services and it also incorporates the concept of SC management.

On the basis of survey, different people gave their opinions and their relative contributions are shown in Figures 7-11.

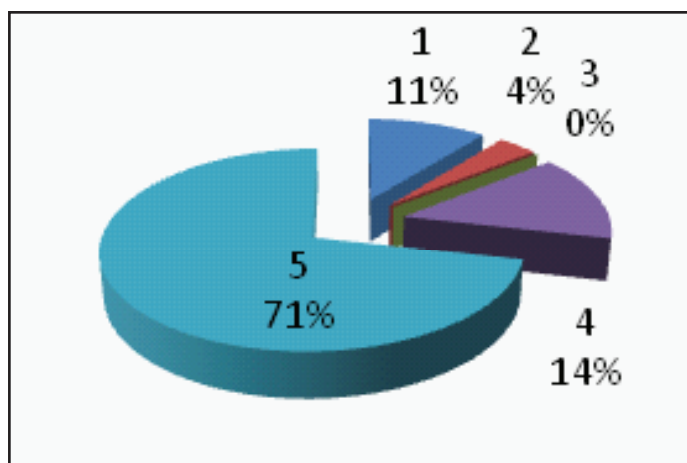


Fig. 2: Telecom’s Understanding Customer Value: Here most people agreed upon score: - 5 (Strongly Agree)

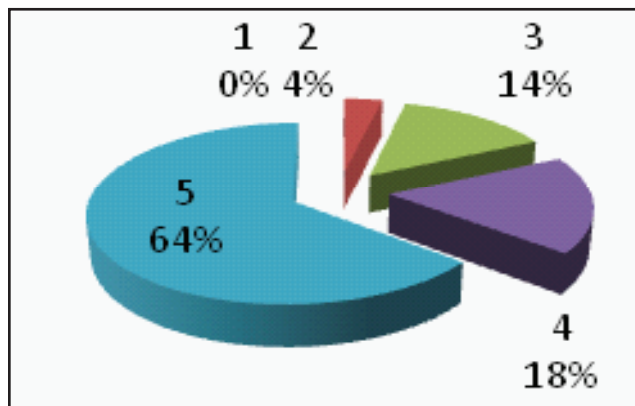


Fig. 3: Telecom’s Coordination Between Supply and Marketing: Here Most People Agreed Upon Score: - 5 (Strongly Agree)

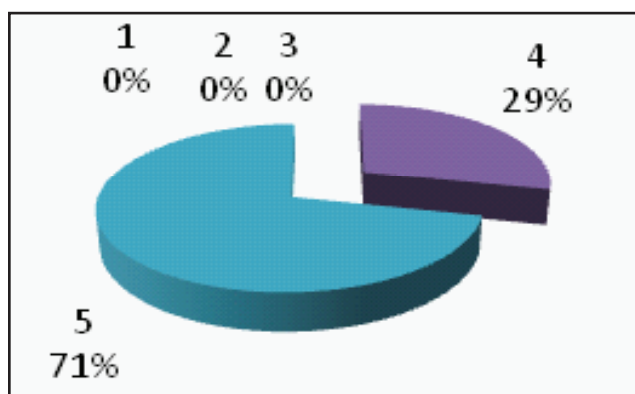


Fig. 4: Telecoms' Continuous Up gradation: Here Most People Agreed Upon Score: - 5 (Strongly Agree)

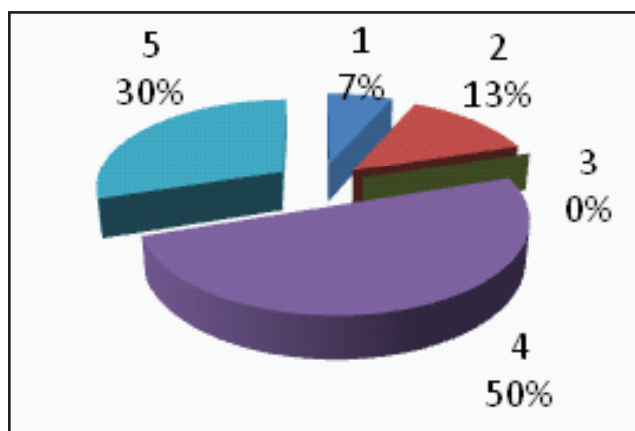


Fig. 5: Telecom's Schemes Affecting Customer Values: Here most people agreed upon score: - 4 (Agree)

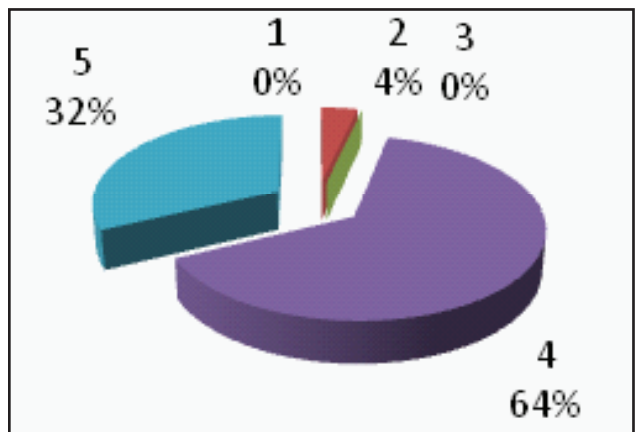


Fig. 6: Telecom's Adherence To Customer Grievances: Here most people agreed upon score: - 4 (Agree)

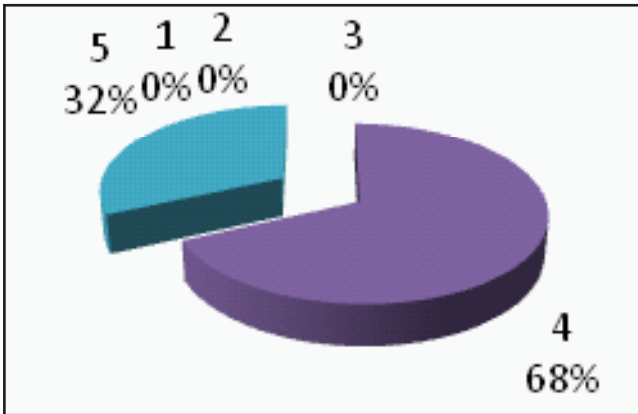


Fig. 7: Medical's Understanding Customer Value: Here most people agreed upon score: - 4 (Agree)

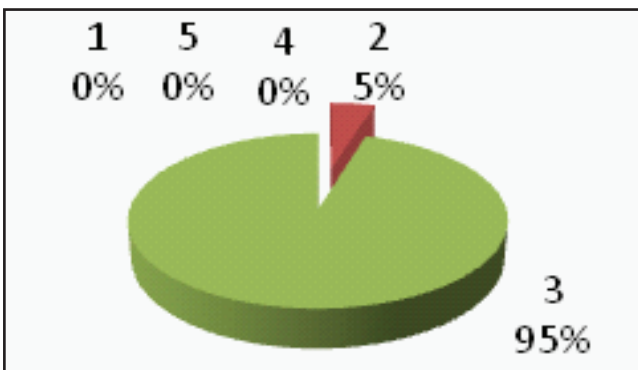


Fig. 8: Medical Coordination Between Supply and Marketing: Here most people agreed upon score: - 3 (Neither Agree nor Disagree)

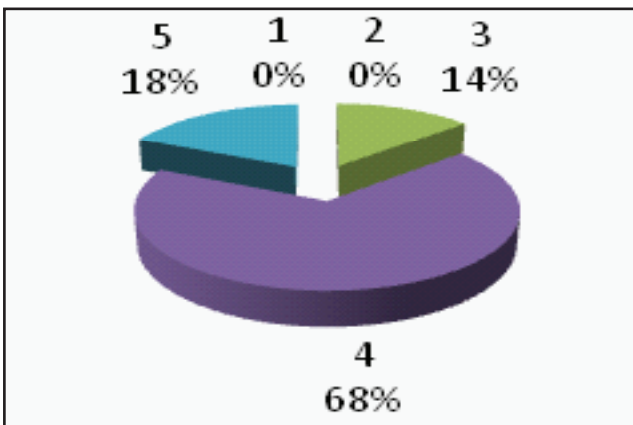


Fig. 9: Medical's Continuous Up gradation: Here most people agreed upon score: - 4 (Agree)

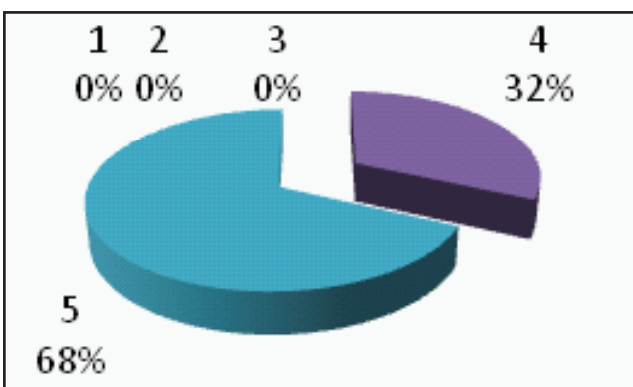


Fig. 10: Medical's Schemes Affecting Customer Values: Here most people agreed upon score: - 5 (Strongly Agree)

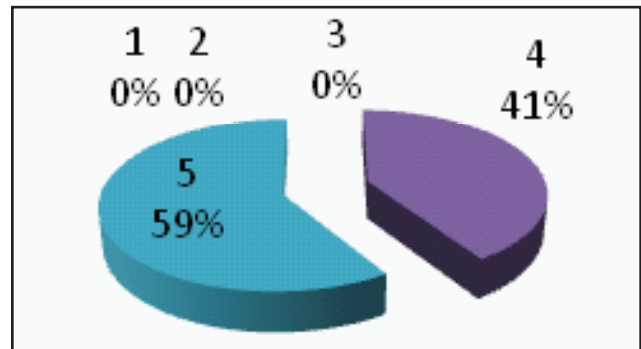
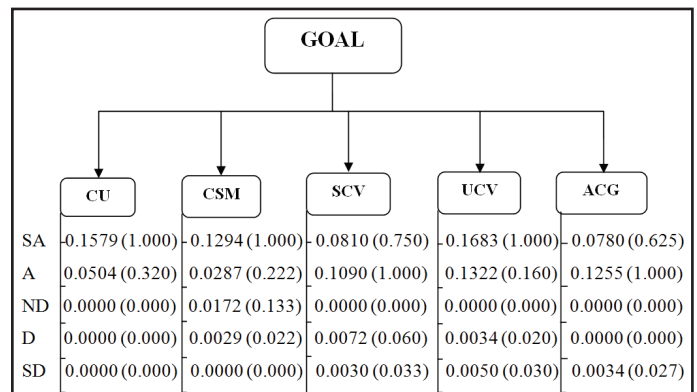


Fig. 11: Medical's Adherence To Customer Grievances: Here Most People Agreed Upon Score: - 5 (Strongly Agree)

VI. Results and Analysis

A. Telecom Sector



Where, SA = Strongly Agree; A = Agree; ND = Neither Agree nor Disagree; D = disagree; and SD = Strongly Disagree.

Fig. 12: Telecom's Variable evaluation Hierarchy

Relative priority table for all the top five factors are:

1. Understanding Customer Value

Table 2: UCV's pair wise comparison matrix for Telecom

UCV	SA	A	NAND	D	SD	Priorities
SA	1.0	2.0	3.0	4.0	5.0	0.8264
A	1.0/2.0	1.0	2.0	3.0	4.0	0.1322
NAND	1.0/3.0	1.0/2.0	1.0	1.0/2.0	1.0/3.0	0.0000
D	1.0/4.0	1.0/3.0	2.0	1.0	1.0/2.0	0.0165
SD	1.0/5.0	1.0/4.0	3.0	2.0	1.0	0.0247

Inconsistency Ratio = 0.0002

2. Coordination between Supply & Marketing

Table 3: CSM's pair wise comparison matrix for Telecom

CSM	SA	A	NAND	D	SD	Priorities
SA	1.0	2.0	3.0	4.0	5.0	0.7258
A	1.0/2.0	1.0	2.0	3.0	4.0	0.1612
NAND	1.0/3.0	1.0/2.0	1.0	2.0	3.0	0.0967
D	1.0/4.0	1.0/3.0	1.0/2.0	1.0	2.0	0.0161
SD	1.0/5.0	1.0/4.0	1.0/3.0	1.0/2.0	1.0	0.0000

Inconsistency Ratio = 0.0002

3. Continuous Upgradation

Table 4: CU's Pair Wise Comparison Matrix for Telecom

CU	SA	A	NAND	D	SD	Priorities
SA	1.0	2.0	3.0	3.0	3.0	0.7575
A	1.0/2.0	1.0	2.0	2.0	2.0	0.2424
NAND	1.0/3.0	1.0/2.0	1.0	1.0	1.0	0.0000
D	1.0/3.0	1.0/2.0	1.0/1.0	1.0	1.0	0.0000
SD	1.0/3.0	1.0/2.0	1.0/1.0	1.0/1.0	1.0	0.0000

Inconsistency Ratio = 0.0001

4. Scheme affecting Customer Value

Table 5: SCV's Pair Wise Comparison Matrix for Telecom

SCV	SA	A	NAND	D	SD	Priorities
SA	1.0	1.0/2.0	3.0	4.0	5.0	0.4054
A	2.0	1.0	2.0	3.0	4.0	0.5405
NAND	1.0/3.0	1.0/2.0	1.0	1.0/2.0	1.0/3.0	0.0000
D	1.0/4.0	1.0/3.0	2.0	1.0	2.0	0.0360
SD	1.0/5.0	1.0/4.0	3.0	1.0/2.0	1.0	0.0180

Inconsistency Ratio=0.0001

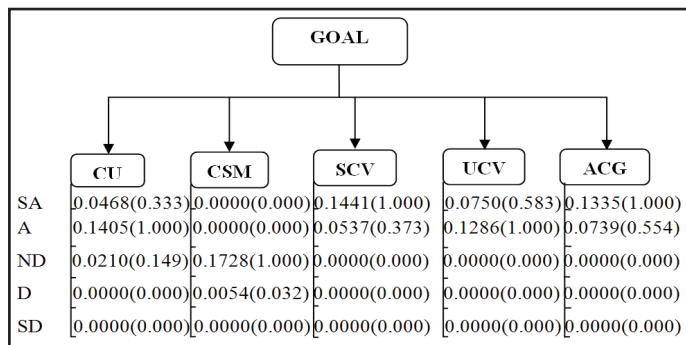
5. Adherence to Customer Grievances

Table 6: ACG's Pair Wise Comparison Matrix for Telecom

ACG	SA	A	NAND	D	SD	Priorities
SA	1.0	1.0/2.0	3.0	4.0	5.0	0.3781
A	2.0	1.0	2.0	3.0	4.0	0.6050
NAND	1.0/3.0	1.0/2.0	1.0	2.0	1.0/3.0	0.0000
D	1.0/4.0	1.0/3.0	1.0/2.0	1.0	1.0/2.0	0.0000
SD	1.0/5.0	1.0/4.0	3.0	2.0	1.0	0.0168

Inconsistency Ratio=0.0001

B. Medical Sectors



Where, SA = Strongly Agree; A = Agree; ND = Neither Agree nor Disagree; D=disagree; and SD = Strongly Disagree.

Fig. 14: Hospital's Variable evaluation Hierarchy

Relative priority table for all the top five factors are:

1. Understanding Customer Value

Table 7: UCV's Pair Wise Comparison Matrix for Hospital

UCV	SA	A	NAND	D	SD	Priorities
SA	1.0	1.0/2.0	3.0	3.0	3.0	0.3684
A	2.0	1.0	2.0	2.0	2.0	0.6315
NAND	1.0/3.0	1.0/2.0	1.0	1.0	1.0	0.0000
D	1.0/3.0	1.0/2.0	1.0/1.0	1.0	1.0	0.0000
SD	1.0/3.0	1.0/2.0	1.0/1.0	1.0/1.0	1.0	0.0000

Inconsistency Ratio=0.0001

2. Coordination between Supply & Marketing

Table 8: CSM's Pair Wise Comparison Matrix for Hospital

CSM	SA	A	NAND	D	SD	Priorities
SA	1.0	2.0	1.0/3.0	1.0/4.0	5.0	0.0000
A	1.0/2.0	1.0	1.0/2.0	1.0/3.0	4.0	0.0000
NAND	3.0	2.0	1.0	2.0	3.0	0.9692
D	4.0	3.0	1.0/2.0	1.0	2.0	0.0307
SD	1.0/5.0	1.0/4.0	1.0/3.0	1.0/2.0	1.0	0.0000

Inconsistency Ratio=0.0001

3. Continuous Upgradation

Table 9: CU's Pair Wise Comparison Matrix for Hospital

CU	SA	A	NAND	D	SD	Priorities
SA	1.0	1.0/2.0	3.0	4.0	4.0	0.2247
A	2.0	1.0	2.0	3.0	3.0	0.6741
NAND	1.0/3.0	1.0/2.0	1.0	2.0	2.0	0.1011
D	1.0/4.0	1.0/3.0	1.0/2.0	1.0	1.0	0.0000
SD	1.0/4.0	1.0/3.0	1.0/2.0	1.0/1.0	1.0	0.0000

Inconsistency Ratio=0.0001

4. Schemes Affecting Customer Values

Table 10: SCV's Pair Wise Comparison Matrix for Hospital

SCV	SA	A	NAND	D	SD	Priorities
SA	1.0	2.0	3.0	3.0	3.0	0.7142
A	1.0/2.0	1.0	2.0	2.0	2.0	0.2666
NAND	1.0/3.0	1.0/2.0	1.0	1.0	1.0	0.0000
D	1.0/3.0	1.0/2.0	1.0/1.0	1.0	1.0	0.0000
SD	1.0/3.0	1.0/2.0	1.0/1.0	1.0/1.0	1.0	0.0000

Inconsistency Ratio=0.0002

5. Adherence to Customer Grievances

Table 11: ACG's pair wise comparison matrix for Hospital

ACG	SA	A	NAND	D	SD	Priorities
SA	1.0	2.0	3.0	3.0	3.0	0.6435
A	1.0/2.0	1.0	2.0	2.0	2.0	0.3536
NAND	1.0/3.0	1.0/2.0	1.0	1.0	1.0	0.0000
D	1.0/3.0	1.0/2.0	1.0/1.0	1.0	1.0	0.0000
SD	1.0/3.0	1.0/2.0	1.0/1.0	1.0/1.0	1.0	0.0000

Inconsistency Ratio=0.0001

C. Computations

1. Medical Sector

For all the top five variables we got following scores considering as a whole:-

- Understanding Customer Value = 4
- Coordination between Supply and Marketing = 3
- Continuous Upgradation = 4
- Schemes Affecting Customer Values = 5
- Adherence to Customer Grievances = 5

We got priorities of these variables according to their score as:-

- Understanding Customer Value: score = 4, priority = 0.1286
- Coordination between Supply and Marketing: score = 3,

priority = 0.1728

(iii). Continuous Upgradation: score = 4, priority = 0.1405

(iv). Schemes Affecting Customer Values: score = 5, priority = 0.1441

(v). Adherence to Customer Grievances: score = 5, priority = 0.1335

Overall Points Gained = $0.1286*0.2037 + 0.1728*0.1783 + 0.1405*0.2085 + 0.1441*0.2018 + 0.1335*0.2075 = \mathbf{0.143081}$

2. Telecom Sector

For all the top five variables we got following scores considering as a whole:-

(i). Understanding Customer Value = 5

(ii). Coordination between Supply and Marketing = 5

(iii). Continuous Upgradation = 5

(iv). Schemes Affecting Customer Values = 4

(v). Adherence to Customer Grievances = 4

We got priorities of these variables according to their score as:-

- Understanding Customer Value: score = 5, priority = 0.1683

- Coordination between Supply and Marketing: score = 5, priority = 0.1294

- Continuous Upgradation: score = 5, priority = 0.1579

- Schemes Affecting Customer Values: score = 4, priority = 0.1090

- Adherence to Customer Grievances: score = 4, priority = 0.1255

Overall Points Gained = $0.1683*0.2037 + 0.1294*0.1783 + 0.1579*0.2085 + 0.1090*0.2018 + 0.1255*0.2075 = \mathbf{0.138314}$

VII. Conclusion

In 21st century service sector is booming and dominating as compare to manufacturing sector. It is therefore effectiveness of SC of service sector is the talk of the day. This paper has considered two prominent service sectors, namely medical and telecom. The relative importance of different variables in descending order is Continuous Up gradation, Adherence to Customer Grievances, Schemes Affecting Customer Values, and Coordination between supply and marketing. In concerned servicing industries taken as a whole the variable which emerged as the strongest variable is Adherence to Customer Grievances. After computation it has been observed that Medical Sector is more effective than Telecom sector due to keen competition and owned by private groups. Paper can conclude that effectiveness of supply chain in Medical sector is judged to be best among the two selected service sectors. Finally, this paper will be a guideline to compare the different attributes of service sectors.

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R. P. Ajitab is pursuing his Master's in Business Administration in School of Management Studies (SOMS), Indira Gandhi National Open University, India. After graduating in Mechanical engineering from School of Mechanical Engineering, KIIT University, Bhubaneswar, India, he is currently working as the Assistant Manager at TATA Steel, Kalinganagar, Jajpur Road, Odisha. His research area of interest is Supply chain management,

Operations management and statistical analysis.



Aishwarya Dash is presently continuing Master in Technology in the specialization of Industrial Engineering and Management in College of Engineering and Technology, B.P.U.T, Bhubaneswar, Odisha, India. She has received Bachelor Degree from I.G.I.T Sarang, B.P.U.T, Dhenkanal. Her area of Interest are Production Planning and Inventory Control, Quality Engineering and Management, Supply chain Management, Operation

Research.



Dr. Sushanta Tripathy is presently working as a Professor at the School of Mechanical Engineering in KIIT University, Bhubaneswar, Odisha, India. He has completed his PhD from the Department of Industrial Engineering and Management, Indian Institute of Technology, Kharagpur. His major areas of interest include production operations management, multivariate analysis, service operations management, supply chain management and productivity management. He is a Fellow of Institution of Engineers, India.



Dr. Trupti Ranjan Mahapatra, is working currently as an Assistant Professor at the School of Mechanical Engineering, KIIT University, Bhubaneswar, Odisha, India. He has completed his PhD from KIIT University on the nonlinear vibration of composite structures. He has major research interest in composite structures, smart structures, FGMs. He is also trying his hand in optimization engineering and project management. He is a Fellow of Institution of Engineers, India.