

Modeling the barriers of Indian logistics service providers: ISM approach

Anchal Gupta

Delhi School of Management, Delhi Technological University, Delhi- India

Rajesh K Singh

Management Development Institute, Gurgaon, India

Pradeep Suri

Delhi School of Management, Delhi Technological University, Delhi

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Abstract

In today's competitive business environment, organizations outsource their logistics activities to the Logistics Service Providers (LSPs) for the sake of cost reduction, focus on core competencies and time saving. Service Quality becomes an order winning attribute for all the service providers. The selection and continuity of business of LSPs depends on the level of services delivered and the satisfaction of the customer from the services. In developing countries like India, Logistics sector contributes around 14% in GDP. The increasing dependency of organizations on logistics service providers due to boom in e-commerce industry and initiatives like MAKE in India, will definitely shows substantial growth for LSPs. The LSPs need to redesign their strategies in order to grab all upcoming opportunities. Although Government of India has already began with many mega infrastructural projects to support LSPs but still it is not synchronized with increased industry requirements. Many barriers like infrastructural bottlenecks, shortage of skilled workforce and inefficient inspection strategies etc. come across in delivering high quality services to the end customers. In this study, it has been attempted to identify and analyze the key barriers which impede the effective service quality of logistics service providers. Based on the literature review and experts' opinion, eleven key barriers to logistics service providers are identified. A structural relationship model is developed by using Interpretive Structural Modeling (ISM) and further barriers are categorized as drivers, dependent, autonomous and linkage variables based on their driving and dependence power with the help of MICMAC Analysis. Based on MICMAC analysis, three barriers have been identified as autonomous barriers, four as dependent variables, three as drivers and one as linkage variables. The study is expected to provide useful inputs to practitioners and service providers itself in terms of crafting better strategies which can overcome the identified barriers and can design better solutions for delivering better service quality to their customers.

• Introduction

Due to globalization and competitive markets, almost all organizations outsource their logistics activities to Logistics Service Providers (LSPs) for the purpose of cost reduction, improved delivery performance, time saving and focus on core competencies. LSPs services are now extended from transportation and warehousing to integrated logistics solutions in form of all shopping at one stop (Kumar et al., 2012). Nowadays, Service quality becomes a critical element responsible for business performance. LSPs have to meet the challenging role of delivering best quality services to their customers for their business continuity and future business.

Due to rise in e-commerce industry and the Government initiative of "MAKE IN INDIA", there will be ample opportunities for LSPs to grow and expand their businesses. Rise in globalization and advancement of technology can also be considered as responsible reasons for organizations to redesign their strategies and develop products to serve global needs through logistics service provider's capabilities.

The major hurdles which occur in providing the desired level of quality services especially in Indian context are highly fragmented unorganized sector, lack of government support, infrastructural bottlenecks, lack of efficient technical systems, skill shortages and behavioral complexities etc. These obstacles sometimes become an important cause of failure of desired logistics services. To ensure smooth services from logistics service providers, barriers need to be identified and removed. Appropriate framework for overcoming these barriers need to be also proposed. Therefore the major objectives of this study are:

- to identify barriers of logistics service providers for improving service quality.
- to develop a structural relationship framework for these barriers by Interpretive Structural Modelling (ISM) approach.
- to find driving power and dependence power and categorisation of these factors into different categories by MICMAC analysis.

The remaining part of paper is organised as follows. In section 2, literature review of identified barriers of logistics service providers is discussed. Remaining part of the paper is organised as follows. Section 2 deals with review of e-governance implementation barriers. Section 3 deals with Interpretive Structural Modelling (ISM) of factors. Section 4 classifies the barriers on the basis of driving and dependence power, with the help of MICMAC Analysis and ISM model development in section 5. Section 6 includes discussion and finally conclusion in section 7.

• **Literature Review**

The role of logistics service providers is very essential in conducting smooth flow of material and information in both upstream and downstream of supply chain (Kumar et al., 2012). The contribution of 3PLs services has increased to a big extent due to its direct and indirect benefits throughout the world. Various authors analyzed 3PL businesses, their categorization, structure and services on the basis of different types of industries they served (Marasco, 2008).

Tezuka(2011) highlights the three characteristics of service provider as integrated, contract and consulting service providers. Most of the firms are dependent on logistics providers for their warehousing activities, wide geographical coverage, developed IT solutions and strong network. Transportation activities (61.8%) is considered to be the most important logistic function for all the industries, followed by freight forwarding (25.7%), warehousing (8.3%) and VALS (4.1%) (<http://www.frost.com>). The organizations always make attempt for improving the quality of their services with the objective of more satisfied customer and as in turn, more satisfied customer can be proven as more loyal customer. The improvement in quality of services helps organizations to reduce cost as well as to increase profits at the same time.

There is need to identify and analyze the barriers to logistics service providers in delivering desired quality to the end customers. Based on literature review and experts opinion, various barriers are identified as shown in Figure 1.

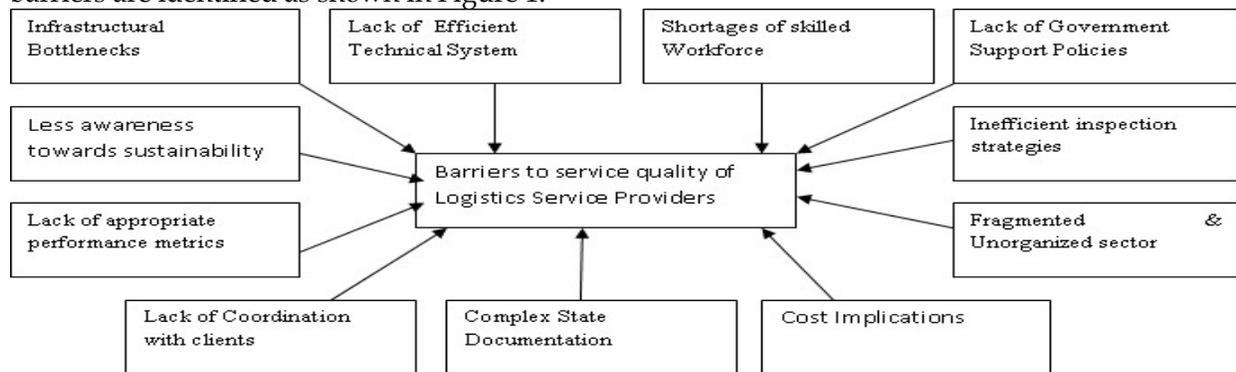


Figure1: Barriers of Logistics Service Providers

2.1 Barriers of logistics service providers in providing quality services

In spite of many best practices followed by LSPs, some challenges can hinder their path to success. Some unavoidable issues create bottlenecks in providing quality services to end users.

1. **Infrastructural bottlenecks:** Logistics infrastructure is a critical enabler for economic development and urbanization. India has already taken steps to expand road and rail networks and modernizing harbors and airports (Venkatesh et al., 2017). In the process of globalization, India is making better position in world trade channeling upsurge in transport volume. But, expansion of logistics infrastructure is not in sync with increased industry requirements as shown in table 1. This is one of the important reasons of failures of transport capacities as per the requirement. Pathetic condition of roads, poor connectivity and inadequate air and seaport capacities are the major infrastructural bottleneck (Sahay et al.,2006). Inadequate infrastructure promotes corruption on highways and hinterlands.

2.

Mode of Transport	Infrastructure	Key Constraints
Road	Total road network- over 5,472,144 kilometres (3,400,233 mi) in 2015 National highways include 2% of Indian roads, they handled 40% of the traffic.	Bad condition of roads Low average speed(30-40km/hr) Low Daily average distance travelled(250 km) Issues at check-post and toll-post
Railways	Total Track Length-119,630 Kms (74,330 mi) in 2016	Low service guarantee No dedicated freight corridors Low connectivity to industry No fixed schedule for departure/arrival
Airports	Domestic/International Airport- 125 5 main metros account for over 85% of total freight traffic	Only major airports has infrastructure to handle air cargo High Waiting time Poor warehousing infrastructure
Ports	Ports-212(Major 12 & Minor 200) Capacity-Major ports at 500mm MT and Minor ports at 230mn MT	Heavy congestion at ports Lack of good connectivity with roads Out-dated equipment and technology Low port capacities and number of berths

Table 1: Core Infrastructural Bottlenecks

3. **Lack of coordination with clients:** There is need to develop a deeper understanding of behavioral complexities which can be emerged through interaction between the client and logistics providers (Harland et al., 2007; Marasco,2008).Many logistics providers have initiated approach of relationship marketing in order to investigate behavioral attributes of 3PL arrangements and their links with outcomes of such relationships. This is basically to understand the bonding processes and philosophies within 3PL arrangement which can enhance successful client-supplier relationships (Rajesh et al., 2011).

4. **Complex State Documentation:** In India, each state has different type of policy framework, compliances and tax laws which is governed by state Government (Mitra, 2006). Due to variations in complex processes at state level, a big hurdle of document handling and taxation policies occurs in the operations of logistics service providers (Sharma et al., 2011). Although, Government has already decided to initiate Goods and Service Tax (GST) which is the

comprehensive tax on manufactured goods and services throughout India to replace taxes levied by Central and the State Government.

5. **Fragmented and unorganized Sector-** Lack of policy framework, infrastructure issues, unskilled manpower in the trade and fragmented and unorganized business share (More than 90% of LSPs are those who own less than 2 trucks and 95% are those who own less than 5 trucks) impairs quality of services. (Mitra, 2006; Ding et al., 2012; Outlook Logistics, 2015)
6. **Lack of Government Support Policies-** Despite 14 percent contribution towards GDP, logistics business in India is still not referred to as an industry. However, millions of employment opportunities are developed by this sector. In today's business world, Logistics sector is the backbone and key driver to economic and industrial growth. Governmental focus is still missing towards policy framework, development and recognition of logistics business as an industry (Govindan et al., 2014; Luthra et al., 2011).
7. **Lack of appropriate performance metrics-** There is no benchmarks defined for logistics service providers as logistics is not considered as industry in India. Hundreds of logistics providers are providing services with inadequate resources as there is no appropriate performance metrics are defined for establishment and selection of service provider (Rajesh et al., 2011). This is a big barrier which is affecting the logistics service.
8. **Shortages of Skilled Workforce-** In India, there is lack of specialized training and education in logistics business .Despite of very high contribution to GDP, unlike engineering or manufacturing sector, there is hardly any focus on training, education and technical knowledge of employees (Govindan et al., 2014).
9. **Less awareness towards sustainability measures-** Unawareness of LSPs towards sustainability is an important leads in low implementation of sustainable practices (Abbasi and Nilsson, 2016; Colicchia et al., 2013). Very few LSPs in India shows concern towards environment and use reusable and recyclable pallets, eco-friendly vehicles and green processes in their operations. Still, there is need to create awareness so that many more can start adopting sustainable practices and make optimum use of available resources.
10. **Cost Implications-** Logistics is a high cost and low-margin business (Mitra, 2006). LSPs always have shortage of adequate working capital due to untimely payments by Indian shippers. Poor physical and communications infrastructure is another deterrent to attracting investments in the logistics sector. Apart from the non-uniform tax structure, Indian LSPs have to pay numerous other taxes. High costs of operation and delays involved in compliances with varying documentation requirements of different states make the business unattractive.
11. **Inefficient Inspection Strategies-**In India, the inspection strategies and policies adopted by customs and border authorities are inefficient. Multiple handling at check-posts leads to delay and damages to goods. The Central and State Government levied various direct and indirect taxes on goods which makes their movement difficult within and across countries.
12. **Lack of Efficient Technical System-** Advanced IT tools are already in process which help end users to trace and track their shipments but there are around only 2% LSPs which follow these practices (Luisa et al., 2013). India is upgrading its resources technically but adoption rate is still very low. There is need to develop efficient technical systems and create awareness about importance of IT adoption to all the stakeholders for better economic development (Sauvage,

2003).

3. ISM methodology and model development

Interpretive Structural Modeling (ISM), was first proposed by J. Warfield in 1974, a computer assisted methodology that helps in dealing with complex issues by identifying the relations between variables involved in complex issues/problems under study. It helps in better understanding the fundamentals of any complex problem/situation, as well as to put together a course of action for solving it.

ISM can act as a tool for imposing order and direction on the complexity of relationships among elements of a system (Sage, 1977). It is Interpretive as it enables individuals or groups to develop mapping/relationships between variables of the complex system. It is structural as it simplifies the complex structure into simple modules, on the basis of relationship. It is a modeling technique as it portrays overall structure and specific relationships in carefully designed patterns employing graphics as well as words.

The applications of ISM methodology are not limited to specific fields. It has been widely used by many researchers in different areas. Singh et al. (2008) applied the ISM methodology to the field of knowledge management to understand the relationship among barriers in implementing knowledge management. Mandal et al. (1994) have employed ISM methodology in vendor selection process and identified the key variables using direct and indirect relationships amongst the variables. Some more instances where ISM methodology applied are: Supply chain sustainability (Faisal, 2010), Supply chain agility (Agarwal et al., 2007), Competitiveness of SMEs (Singh et al., 2007b), IT enablement of supply chain (Jharkharia et al., 2005), Reverse Logistics (Ravi et al., 2005) and many other fields. The various steps for ISM are shown in table 2.

S.No	Steps for Interpretive Structural Modelling (ISM)
1.	Identify barriers from the problem under study.
2.	Develop contextual relationship among barriers by taking inputs from experts.
3.	Build Structural Self-Interaction Matrix (SSIM) for the barriers based on symbols (discussed below).
4.	Develop Reachability matrix from SSIM matrix and check for transitivity of matrix. (Transitivity: A-> B; B-> C then A-> C)
5.	Partition of Reachability matrix into different levels.
6.	Diagraph is developed and transitive links are removed from Reachability matrix.
7.	Convert diagraph into ISM based model by replacing variables nodes with statements.
8.	Review the ISM model and check for any conceptual inconsistency or if required make necessary changes.

Table 2: Steps for ISM (Warfield,1974)

3.1 Structural Self Interaction Matrix (SSIM)

For analyzing the barriers in developing SSIM, the following four symbols have been used to denote the direction of relationship between barriers (I and j)
V-barrier i will lead to barrier j; A-Barrier j will lead to barrier i; X-Barrier i and j will lead to each other; O -Barrier i and j are unrelated.

The inputs for developing SSIM among all identified barriers as shown in figure1 have been taken from four experts from Indian logistics sector. All the experts are from middle and top management working in well known logistics companies of India. They were consulted in

identifying the nature of contextual relationships among the barriers to understand the real issues of the industry.

Barrier No.	Barrier Description	Barrier Number										
		1	1	9	8	7	6	5	4	3	2	1
1	Infrastructural Bottlenecks	V	V	V	O	X	V	A	V	O	O	
2	Lack of coordination with clients	X	X	V	O	A	A	A	V	A		
3	Complex State Documentation	A	A	V	O	A	A	V	O			
4	Fragmented & Unorganized Sector	O	O	A	A	A	O	O				
5	Lack of Government support Policies	X	O	V	O	X	O					
6	Lack of appropriate performance metrics	X	O	O	O	A						
7	Shortages of Skilled Workforce	V	O	O	O							
8	Unawareness towards sustainable practices	V	O	V								
9	Cost Implications	A	O									
10	Inefficient Inspection Strategies	A										
11	Lack of efficient Technical Systems	X										

Table 3: Structural self-Interaction matrix (SSIM)

3.2 Reachability Matrix

Initial Reachability matrix (**Binary matrix**) can be made by converting SSIM Matrix into binary form as shown in Table 4, by substituting V,A,X and O by 1 or 0 as per given case. The substitution of 1s and 0s are as per the following rules:

- If (i,j) value in SSIM is V then (i,j) value in the reachability matrix will be 1 and (j,i) value will be 0;
- If (i,j) value in SSIM is A then (i,j) value in the reachability matrix will be 0 and (j,i) value will be 1;
- If (i,j) value in SSIM is X then (i,j) value in the reachability matrix will be 1 and (j,i) value will be 1;
- If (i,j) value in SSIM is 0 then (i,j) value in the reachability matrix will be 0 and (j,i) value will be 0;

There is also need to check for transitivity. It is checked for all possible transitive links and all revisions done are mentioned in table 4. The driving power and dependence power of each barrier is calculated. The driving power for each barrier is the total number of barriers (including itself), which it may help achieve. The dependence power is the total number of barriers (including itself), which may help achieving it.

Barrier No.	Barrier Description	Barrier Number										Driving Power	
		1	2	3	4	5	6	7	8	9	10		11
1	Infrastructural Bottlenecks	1	0	0	1	0	1	1	0	1	1*	1	7
2	Lack of coordination with clients	0	1	0	1	0	0	0	0	1	1	1	5
3	Complex State Documentation	0	1	1	0	1	0	0	0	1	0	0	4
4	Fragmented & Unorganized Sector	0	0	0	1	0	0	0	0	0	0	0	1
5	Lack of Government support Policies	1	1	1*	0	1	0	1	0	1	0	1	7
6	Lack of appropriate performance metrics	0	1	1	0	0	1	0	0	0	0	1	4
7	Shortages of Skilled Workforce	1	1	1	1	1	1	1	0	0	0	1	8
8	Unawareness towards Sustainable Practices	0	0	0	1	0	0	0	1	1	0	0	3
9	Cost Implications	0	0	0	1	0	0	0	0	1	0	0	2
10	Inefficient Inspection Strategies	1	1	1	0	0	0	0	0	0	1	0	4
11	Lack of efficient Technical Systems	0	1	1	0	1	1	0	1*	1	1	1	8
	Dependence Power	4	7	6	6	4	4	3	2	7	4	6	

Table 4: Reachability Matrix

3.3 Level Partitions

From the final reachability matrix, the reachability and antecedent set for each barrier. The reachability set is a set of variables (including itself) which it may help achieve whereas antecedent set is a set of variables (including itself) which may help achieving it. Thereafter, intersection of these sets is derived for all barriers. The barriers for which the reachability and the intersection sets are same, they occupy the top most level in the hierarchy of ISM model. Once the top most layer is identified, it is separated out from the other variables. Then, the same process will be repeated to find out variables in the next level (as shown in table 5). The process is continued till the level of

each variable is identified (as shown in table 6). These levels help in building the digraph and ISM model.

Barrier Number	Reachability Set	Antecedent Set	Intersection	Level
1	1,4,6,7,9,10,11	1,5,7,10	1,7,10	
2	2,4,9,10,11	2,3,5,6,7,10,11	2,10,11	
3	2,3,5,9	3,5,6,7,10,11	3,5	
4	4	1,2,4,7,8	4	I
5	1,2,3,5,7,9,11	3,5,7,11	3,5,7,11	
6	2,3,6,11	1,6,9,11	6,11	
7	1,2,3,4,5,6,7,11	1,5,7	1,5,7	
8	4,8,9	8,11	8	
9	4,9	1,2,3,5,8,9,11	9	
10	1,2,3,10	1,2,10,11	1,2,10	
11	2,3,5,6,8,9,10,11	1,2,5,6,7,11	2,5,6,11	

Table 5: Level partitions: Iteration-1

Barrier Number	Reachability Set	Antecedent Set	Intersection	Level
1	7	7	7	VI
2	2,10,11	2,3,5,6,7,10,11	2,10,11	III
3	3,5	3,5,6	3,5	IV
4	4	1,2,4,7,8	4	I
5	7	7	7	VI
6	6	1,6,9	6	V
7	7	7	7	VI
8	8	8,11	8	III
9	9	1,2,3,5,8,9,11	9	II
10	1	1	1	V
11	6	1,6,7	6	V

Table 6: Levels of all LSPS barriers in providing effective service quality

4. Classification of Barriers

The MICMAC analysis assists in development of graphs to classify LSPs barriers on the basis of their driving and dependence power. They are classified into four categories as autonomous barriers, dependent barriers, linkage barriers and independent barriers. These classifications of barriers are similar to classifications used by Mandal and Deshmukh (1994).

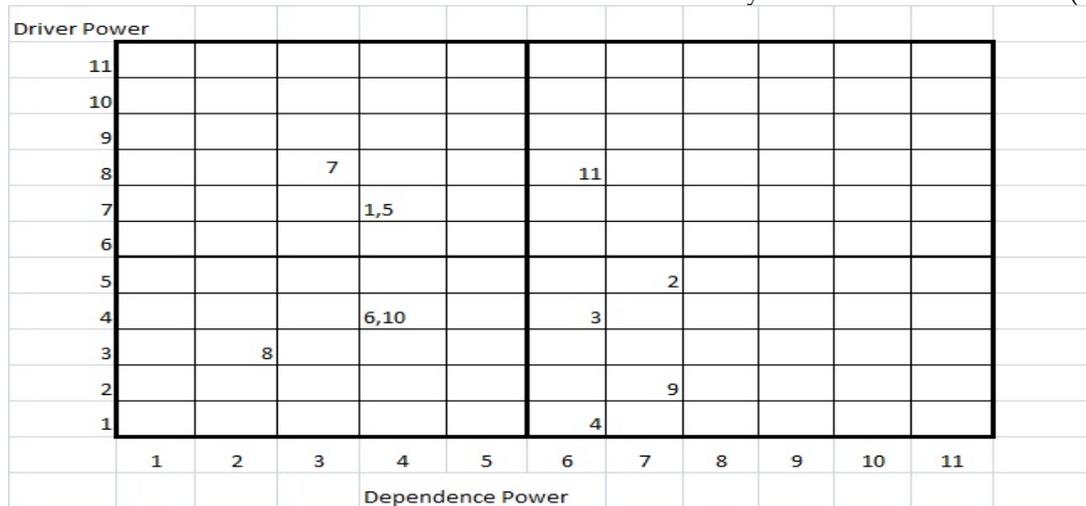


Figure 2: Cluster of LSPs Barriers

In the classification of barriers, the first cluster is autonomous barriers that have weak driving power and weak dependence power. The autonomous variables are relatively disconnected from the system. (Barriers like 6,8,10 from Figure 2). The second cluster is dependent barriers which has weak driving power and high dependence power (Barrier like 2,3,4 and 9 from Figure 2). The third cluster consist of linkage barriers which has high driving power and high dependence power. These barriers have high links with other barriers and also a feedback effect on themselves (Singh et al., 2008) (Barriers like 11 from Figure 2). The fourth cluster is driver variables which has high driving power and low dependence power (Barriers like 1, 5 and 7 from Figure 2)

5. Formation of ISM Model

The structural model is generated from final reachability matrix (Table 5). The relationship between the barriers i & j are presented by an arrow which points from i to j . This graph is called as an initial directed graph or diagraph. After removing the transitivity, the ISM based model is shown in Figure 3.

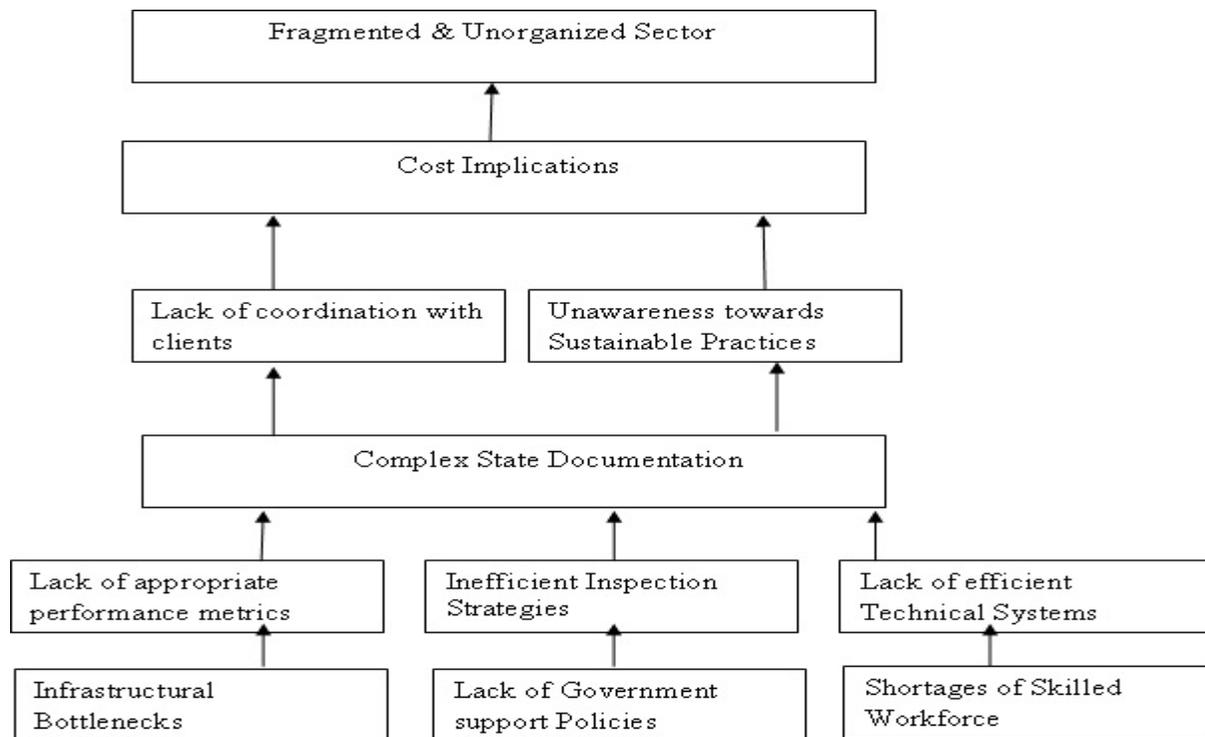


Figure 3: ISM Based Model

6. Discussion

It is important to understand the levels of LSPs barriers for providing effective service quality to their customers. "Fragmented and Unorganized Sector" and "Cost Implications" barriers are occurring at the top levels of the structural ISM model as autonomous variables as shown in figure 4. They have weak driving and dependence power which makes them disconnected from the system. The resources, processes and strategies of individual logistics service providers make high impact on the quality of services provider rather than the huge competition due to fragmentation and cost differences (Kumar et al., 2012). Therefore, the top most barriers are not of too much importance. "Lack of coordination with clients", "Unawareness towards sustainable practices" and "Complex State Documentation" are positioned at the third and fourth level in the hierarchy but

they do not create major hurdles due to their high dependency on other barriers. They usually are dependent barriers with high dependence power and weak driver power. Complex state documentation and unawareness towards sustainable practices barriers are clearly dependent on lack of government support policies. Now in India, Government is coming up with many initiatives like GST, Make in INDIA, and Increased use of eco-friendly and green products so, we can expect things will be better in near future and these barriers can be rectified.

“Lack of appropriate performance metrics”, “Inefficient Inspection Strategies” and “Lack of Efficient Technical Systems” are coming at fifth level of ISM model. Lack of appropriate performance metrics and inefficient inspection strategies barriers shows the requirement to strengthen the performance measurement processes and improve the level of quality of services delivered. They are more of autonomous barriers which are required to be rectifying separately, by defining strict internal and external auditing compliances. “Lack of Efficient Technical Systems” is coming to be as linking variable which have high links with other barriers and also a feedback effect on themselves (Singh et al. 2007a). These barriers need to deal with utmost care and rectify them for betterment. “Infrastructural Bottlenecks”, “Lack of Government support Policies” and “Shortages of Skilled Workforce” are at the sixth level of ISM model are driver or independent barriers. They have high driving power and low dependence power which drives all other barriers and removal of these barriers will help in improving service quality of logistics service providers. These are the most crucial barriers which have to be removed on the top priority.

7. Conclusion and future scope

The eleven barriers of logistics service providers in delivering effective service quality are identified from vast literature review and expert opinion. The barriers are clubbed into different clusters by ISM methodology for in-depth understanding about the nature and impact of each barrier on LSPs services. From the study it is observed that the infrastructural bottlenecks, lack of Government support policies and shortages of skilled workforce are the most crucial barriers which are faced by Indian service providers. Although the Government has initiated various projects like Dedicated Freight Corridors (DFC), Inland Water Ways (Coastal line shipping) etc. and many infrastructures related mega projects to overcome these hurdles but still logistic service providers are struggling to provide service quality as per dynamic needs of customers. The Government is also encouraging manpower to learn and upgrade their skills by associated with many programs like Pradhanmantri Kaushal Vikas Yojna etc. The Government has started taking steps in the direction of improvement but still a long way to go to meet the exact requirements. Lack of efficient technical system is found to be a linking barrier which links all barriers. There is need of availability of technical systems and updated technology adoption for smooth coordination and communication among customers and logistics service providers. Lack of performance metrics, lack of inspection strategies and less awareness of sustainability practices are found to be disconnected from the system. But there is huge requirement of defining and establishing strict performance measures to streamline and improve the quality of services delivered. Currently, logistics service providers are not actively contributing in sustainable practices but it is the need of hour to make optimum utilization of scarce resources. Now, in this research, the relationship between barriers is retrieved using ISM methodology but the results are not checked and validate statistically. To make it statistically valid, a technique, SEM (structured equation modeling), referred as linear structural relationship approach, can be used.

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