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Procedia - Social and Behavioral Sciences 189 (2015) 292 – 302

Procedia
Social and Behavioral Sciences

XVIII Annual International Conference of the Society of Operations Management (SOM-14)

Supply Chain in the Public Procurement Environment: Some Reflections from the Indian Railways

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Abstract

This paper provides analysis of supply chain management framework in the public procurement environment through a case study of the Indian railway. The paper provides some insights about the evolution of supplier relationship management and its impact on key performance indicators. It also provides an integrative framework for management of public procurement. The paper builds on extensive review of literature and follows a case study methodology. The unit of analysis is the Indian Railway's material management function. Analysis uses data of over a period of five years. The finding highlights that supplier relationships with the Indian railway have been geared around arms-length philosophy. The current symptoms of inefficiencies are reflected in high cycle time, high costs associated with supplier selection process, poor accountability, blurring of responsibility and poor value creation for all the stakeholders. The current procurement mechanisms are not crafted around development of long term strategic partnerships. This study is filling the gaps in literature by presenting the challenges of supply chain management in the public procurement environment. Insights from developing country like India can be applied to other public procurement systems. The paper deals with sensitive issue of public procurement system. The findings would be useful for policy makers in developing mechanisms for instilling insights of business management into the realms of public management. The study is first of a kind to provide a conceptual framework for understanding building blocks of the supply chain management in the public procurement environment.

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Peer-review under responsibility of the scientific committee of XVIII Annual International Conference of the Society of Operations Management (SOM-14).

Keywords: Indian Railway; Key Performance Indicator; Public Procurement; Public Policy, Supply Chain Management

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1. Introduction

Indian railway (IR) provides transportation and freight movement services. IR is a public sector undertaking of government of India whose affairs are managed through a ministry of railways. Railway board is the apex body which is chaired by a cabinet rank minister under government of India. Railway board functions at the apex level and is responsible for policy making, target setting, performance monitoring, cadre planning and centralized purchase of high value items comprising of complete rolling stock etc. Railway board member responsible for mechanical engineering is in-charge of activities related with mechanical engineering and material management and is responsible for production and maintenance of rolling stocks like wagons, coaches and diesel locos. Purchases made by railway board comprise 40% of the total purchase.

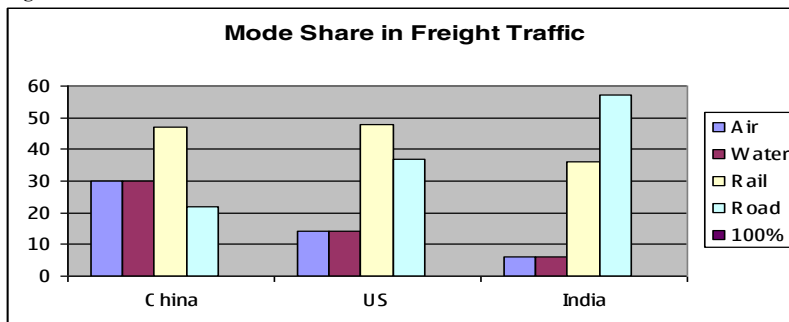
Presently the Indian railway operations involve movement of 19000 trains a day and transportation of 2.9 million tones of freight traffic and 23 million passengers per day. It is world's largest passenger carrier and fourth largest freight carrier. During year 2012-13 the freight loading was more than 1 billion tone and passenger transported stood at 8.4 billion. The Indian railway provides direct employment to 1.3 million people and a much larger indirect employment. In a nut shell the size and operations of the IR is depicted in table 1.

Table 1. The Indian Railway at a glance.

SN	Item (s)	Unit	2011-12	2012-13
1	Assets			
	Route length	Kilometers	64,600	65,436
	Locomotive	Numbers	9,549	9,956
	Passenger Service Vehicles	Numbers	55,347	57,256
	Wagons	Numbers	2,39,316	2,44,731
	Railway Stations	Numbers	7,146	7,172
2	Operations			
	Passenger origination	Millions	8224	8421
	Passenger kilometers	Millions	1046522	1098103
	Freight Traffic (Revenue)			
	Tonnes origination	Millions	969.05	1008.09
3	Volume of Traffic			
	Passenger kms	Millions	10,46,522	1,098,103
	Total traffic (incl.non-revenue)	Millions	975.16	1,014,15
	Freight traffic (Revenue)			
	Tonnes originating	Millions	969.05	1008.09
4	Employment and Wages			
	Regular employees	Thousands	1,306	1,307
5	Financial Results			
	Revenues	In crores of Rs.	1,04,110.36	1,23,732.59
	Expenses	In crores of Rs.	98,667.41	1,11,572.04
	Miscellaneous transactions	In crores of Rs.	1,338.66	1,454.64
	Net revenue (before dividend)	In crores of Rs.	6781.61	13,615.19

(Source- Indian Railway year book 2012-13)

Figure 1. Share of IR Vis-à-vis other modes.



(Source: Material Transport Development policy committee, June 2012)

Railway is a preferred mode of transport because it is having advantage over road in terms of energy consumption,

financial, environmental and social cost. Railway consumes 75% less energy as compare to road. It is safer and less polluting mode of transport. Land requirement per unit of transport is less in case of Railways. Any shift from road to rail traffic would result into huge advantage. Considering these natural advantages, the ideal share of railway should be 80% but over the year share of railway traffic is falling and at present it stood at 30%, roadways at 61% and others such as pipeline, waterways and airways etc. at 9%. This is depicted in figure in 1.

2. Review of Literature

2.1 Public Procurement

Public procurement involves purchases made by public organizations (Uyarra and Flanagan, 2010). Developed economies are spending somewhere up to 25 % of their GDP on public procurement. (Afonso *et al.*, 2005). Research on public procurement focuses on its influences on economic activity (Laffont and Tirole, 1991; Tigner, 1991; Vagstad, 1995; Brulhart and Trionfetti, 2004) as well as the underlying processes involved in the procurement (Bovaird, 2006; Gelderman *et al.*, 2006).

2.2 Operational Performance and Procurement

Operational performance are measure in terms of cost and capacity utilization (Croom and Johnson, 2003; Eng, 2004; Presutti, 2003; Tan *et al.*, 2002). E-procurement system enables operational processes and provides more transparency (Puschmann and Alt, 2005), thereby creating more value creation (Wiengarten *et al.*, 2010).

2.3 Value for money

Value for money (VfM) involves best value received during entire life cycle of a process (Bauld and McGuinness, 2006). This may also involves competence, low cost of capital and credibility (Cummings and Qiao, 2003). Poor capacities of public institutions and non conducive business environment are some of the key challenges (Palmer and Butt, 1985). Value for money is more a philosophy and its context description is difficult owing to the complexity of issues involved, therefore it requires case by case treatment.

2.4 Ethics

Ethics is poorly understood (Atkinson, 2003) and results in weak implementations of norms (Nwabuzor, 2005).

2.5 Competition

Providing equal opportunity to all vendors is central to public procurement. Clear and complete tender information facilitates competitiveness and results in competitive markets.

2.6 Transparency

Transparency is an important tenet of the public management (Smith-Deighton, 2004). Under new public management public bodies strives to follow best in class practices and are ready for audit. Complete and high quality information enables level playing ground, this is more so for international vendors (Arrowsmith, 2003), reduces opportunities for speculative practices (Rege, 2001), results in effective decisions and increases public bodies' capacity to pursue consistent rules (Rothery, 2003).

2.7 Accountability

On one hand accountability is defined at the micro level and on the other hand it is defined at the macro level. Therefore, it is operationalized both at the national as well as at the international level. However, defining the scope of contextual business environment is highly complex and may results in accountability issues (Barrett, 2000).

Stakeholders value issues not only related with tangibility but also with intangibility such as service (Gunasekaran, 2005).

2.8 Achieving Outcomes

Achievements of desired outcomes are outcomes of underlying processes which are tuned to benchmarks and performance indicators (Saad *et al.*, 2005; Sanchez-Rodriguez *et al.*, 2003). Process control through activities of measurement and corrective actions helps in achieving conformance to quality standards (Triantafillou, 2007). Benchmarking of public procurement involves setting and following of contextual best practices (Chamberland, 2005) expressed in terms of cost, quality and delivery (Tudor, 2005). In an organizational settings norms for work culture are mechanisms of formal communication and competency enhancement are identified as enablers of benchmarks Soh *et al.* (2006).

2.9 Gaps in the Literature

This existing literature is developed from the contextual setting of developed countries. The empirical investigation across developing countries is limited to some studies such as in Sri Lanka and Philippines. To the best of researcher's knowledge there are no studies which investigate public procurement in India.

3. Methodology

This paper follows a case study method which is an inquiry of a real life phenomenon having blurred boundaries (Yin, 2003) and involves cycles of description, explanation and testing (Meredith, 1993). Case studies are used to serve the purpose of exploring, describing and explaining the empirical setting (Yin, 2003). The paper follows descriptive feature for the analysis of maintainability of supply chain under public procurement environment in Indian railway. The unit of analysis is public procurement process in upstream supply chain of the Indian railways. Literature on public procurement, supply chain would be reviewed to understand the context and critical issues of the problem. Reports, statistics and other documents published by Indian railway would be used to elicit current status of the procurement process and its associated challenges. This learning would be supplemented with discussions with various stakeholders such as policy makers and people involved in procurement process. The data collection would involve document analysis such as government gazettes, and interview with policy makers in the government and officials of Indian railway. Table 2 depicts various sources of data.

Table 2: Sources of Data

Source of Data	Methods
Government of India	- Five Semi-structured interviews
Officials in ministry of railway	- Documents in the form of policy statements.
- Members of railway board	
Officials at zone level	
- Officers of Indian railway service	

4. Findings and Discussion

4.1 Role of procurement in organization

Any organization public or private requires external resources in pursuit of its objectives. Such resources could be goods, services, works or consultancy. It could be tangible or intangible. Procurement is important strategic business management function to manage entire process from assessment of need, identification of product, forecasting, sourcing, logistics, risks managements, value engineering, supplier relation management and regulatory compliance efficiently and effectively. The function is answerable to objective of organization and expectation of stakes holders which include share holders, employee, customer, society at large, government and environment. Procurement is the science and art of supply management managed by competent, knowledgeable, practitioner and professional.

The procurement function is having the strategic importance as 60-70% of expenditure of an organization is incurred

in the procurement. It helps organization to improve profitability, market share, reducing time from concept to market, improving customer satisfaction, help in research and development (R&D) for better quality, better values, technological improvement, innovation, help in delivering better product and service and mass customization etc.

Public procurement as per the Indian public procurement bill involves acquisitions by purchase, lease, license or otherwise of goods or service or any combination thereof including award of public private partnership project by procurement agency directly or through an agency for which contract for procurement is entered into. Public procurement refers to procurement by government agencies which may be central government, state government, public sector units (PSUs), procurement through multilateral funding or any entity where more than 50% equity is held by Government including procurement under public private partnership (PPP) projects.

The objective of public procurement as defined in public procurement bill placed before the Indian parliament is to ensure transparency, accountability, and probity in the procurement process, fair and equitable treatment to bidders, promotion of competition, enhancement of efficiency and economy, maintenance of integrity and public confidence in the procurement process. Public procurement generally account for large share of government expenditure in the domestic economy. It is having strategic importance as it involves huge expenditure and the purpose for expenditures such as social and other infrastructure is to give boost to the economy. The public procurement expenditure in India per annum is estimated to be more than 15 lakh crore (US \$ 300 billion) which amounts to 25 to 30% of the nation's GDP. A mere saving of few percents would result in substantial amount which can be channeled towards building social and infrastructure sector of the economy. Moreover, efficiently spent public money enables achievement of the laid down policy objectives.

The public procurement is done to achieve macro level policy outcome of government such as safe and tolerant society, well educated citizen and developed and efficient public infrastructure. Government develops planned policy to meet these objectives and execute them. Due to magnitude of spending it has far reaching impact which can be utilized to shape more inclusive national economic growth by longer term support to weaker sectors of industry, economy and society, environment and infrastructure.

4.2 The common in Public and Private Procurement

The basic aim of public or private procurement can be described in terms of right quantity, right quality, right price *i.e.* value for money (VfM), life cycle cost (LCC), total cost of ownership (TCO) concept, right source, right time and place, right and ethical method.

4.3 Difference in Public and Private Procurement

The public and private procurement varies across issues of transparency such as fairness, equality, competitions, appeal rights, professionalism such as economy, efficiency, effectiveness and integrity, responsiveness towards different stake holders, citizen, tax payers, society, constitutional premises under Article 14 for equality and article 19 for freedom of expression, and article 299 for right to information (RTI), multiplicity of goals, public accountability towards agencies such as parliament, central vigilance commission (CVC), central bureau of investigation (CBI), comptroller and auditor general of India (CAGI) etc. and transitional concepts such as evaluating each transition independently.

4.4 Public Procurement on Indian Railways

Material Management deptt on Indian Railway ensures uninterrupted supply of material and stores. It has 262 warehouses and over 1 lakh material component are stocked. During 2012-13 total expenditure on Material was Rs. 36027 crores. Material Management deptt employs 26,660 no. of employee to manage its function. Table 2 depicts a snap shot of IR's purchase.

Table 3. A broad analysis of purchase made by IR.

Items	2011-12 (in crore)	2012-13 (in crore)
Stores for operation, repairs and maintenance	8,302	8,159
Stores for construction	993	1,235
Fuel	10,273	12,558
Stores for manufacture of Rolling Stock and purchase of complete units	11,791	14,075
Total	31,359	36,027

(Source: Indian Railway year book 2012-13)

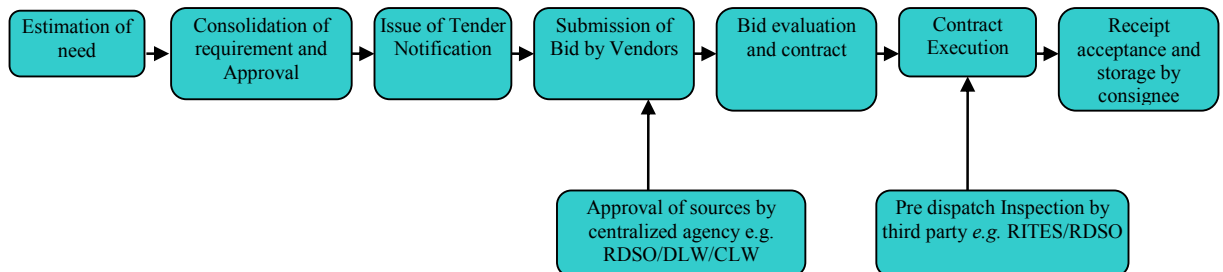
4.5 Theoretical frame work of procurement on the Indian Railway

The items are given item code on the basic of Main Equipment/Assembly and Subassembly wise e.g. Diesel loco spare will have item code starting from 10 to 19, Electric loco spare will have item code starting from 20 to 29. Purchase sub groups are organized on the basic of user group e.g. separate purchase group for procurement of Diesel Loco Spares, Electrical Loco Spares etc.

There is a system of annual procurement of different items by inviting tenders for lump sum quantity required for years. Decision in high value tenders are taken by tender evaluation committee which consist of officers from users, Material Management and finance deptt. It is observed from last 4 year purchase date that most of the items (90-95%) in value terms are procured through approved sources. Approval of sources is done by centralized agency such as Research Design and Standard Organization (RDSO); Diesel Locomotive Works (DLW) or Chittaranjan Loco Works (CLW) etc. While approving the sources the engineering cost estimation of items is not the consideration.

Suppliers are required to arrange inspection of all consignments from 3rd party inspecting agency like RITES and RDSO prior to dispatch of Material. Sources approving agency, procuring agency and inspecting agency are independent to each other. Material is finally received and accepted by consignee who is warehouse incharge and then stocked and issued as per requirement. Suppliers are required to submit bill, in prescribed format along with necessary document, such as Inspection certificate, dispatch details etc. for claiming payment.

Figure 2: Flow chart of Procurement Process



4.6 Evolution of Supply Chain Function

Our last 50-60 years material management function has evolved tremendously. In 1940-50 the head of material management (MM) function in an organization was designated as Chief Store Keeper (CSK). His main focus was availability of material, ware housing and logistic. Excess inventory was not much concern as compared to stock out were penalty was heavy. During 1970-80 with the rise of competition the business realized the importance of MM function as a powerful tool for enhancing competitive advantage and profitability. The designation changes to Material Manager. The focus area was reducing cost of material and cost on material, value engineering and vender development besides availability and Inventory Management.

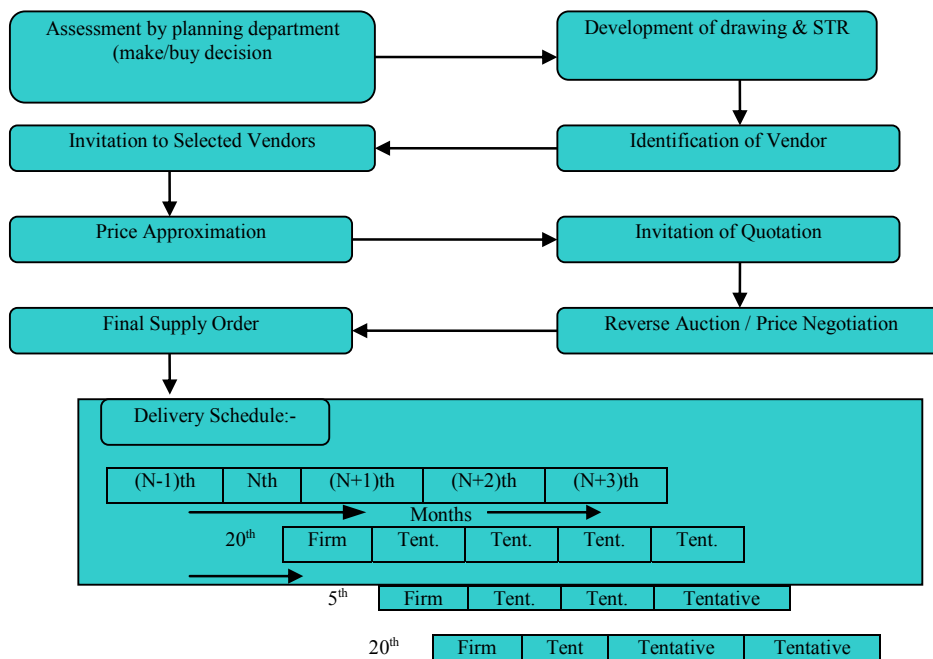
Another quantum jump in role of MM function took place in 1990s when function of inbound logistic and out-bound logistic were clubbed to take advantage of synergy due to commonality of resources and skill. Now this function has evolved to Supply Chain management function and taken the shape of full operation in itself. It encompasses various disciplines and provide framework of analysis befitting in the context of various disciplines. Often customer's decision to purchase a product is driven by downstream supply chain of the service provider. In the continuum of CSK to SC manager, the role of material manager in the IR is between that of CSK and MM. In IR,

value engineering and vendor development are done by RDSO and the contribution of material manager in these activities is insignificant. For the purpose of comparison, the theoretical frame work of supply chain function in a typical automobile industry is represented in the flow chart figure 3

4.7 Evaluation of Supply Chain Function

Performance Measures (PM) can be defined as the process of quantifying efficiency and effectiveness of an action (Gunasekharan and Cobee 2007). Performance measurement system (PMS) provide the necessary information for decision making and action. It plays important role in setting strategic objective, evaluating performance and determining future course of action (Gunasekharan, 2004). The main reason for poor performance of the supply chain is lack of measurement system (Morphy, 1999). The real challenge is, therefore, to develop suitable PMS, so as to improve organization performance and competitiveness. To understand and evaluate the performance of inbound centric supply chain of IR, the key performance indicators (KPIs) of IR are compared with KPI of a typical automobile company.

Figure 3: Theoretical frame work of inbound SC Function of a leading Automobile Co.



For comparison the supply chain of LAC was studied. The cycle time of entering into the contract is approximately 6 months but this contract is on long term basis. Fortnightly delivery requirement with 2 hourly delivery scheduled is given. Average inventory is 2hours, stock out situation are very rare and the procurement managers of LAC are given a target of reduction in bill of material (BOM) by 7% on year-to-year basis. This reduction in BOM is possible by amortising the fixed cost on the life cycle basis and joint value engineering efforts by the buyer and the supplier. Total number of active venders are in range of 290 only.

Table 4. Comparison of KPIs of IR with leading automobile company.

SN	KPI	IR	LAC
1	Availability of stock items	95.6%	100%
2	Stock out situations	4.4%	Nil
3	Cycle time of purchase		
	a. demand generation to contract	198 days	Long term contract (LTC)
	b. contract to 95% supply	163 days	2 Hrs
	Total	361 days	
4	Inventory		
	a. Average physical inventory in months	3 months	2 Hrs
	b. Physical Inventory as on 31/3/13	1.5 months	2 Hrs
5	No. of active vendor	>3000 no.	290
6	Reliability of vendors:-		
	a. % cases of delivering period extension	>10%	Nil
	b. % cases of supply rejection	≈2%	Nil
7	Purchase failure-		
	a. No. of outstanding demands more than 6 month old-	25%	N/A
	b. No. of outstanding demand more than 1 year old	12%	N/A
8	Cost of material- on year to year Target of saving in BOM	5 % increase in a year is generally considered as reasonable	(-7%) Reduction in BOM per annum

4.8 The business process of inbound centric supply chain of IR

System of codification of items requires that each item should have unique item code. On IR the system of assigning item code is related to the end use. In case of commonality of spares in different type of equipment, there is every possibility that the condition of unique item code of each item gets violated. Continuous efforts are done for unification of item code with limited success. Further the procurement point of view classification of item code as per industry category may be better. Purchase sub groups are divided based on the end use of items. This result into purchase of same category of item by different sub groups (for example nylon bushes required for Diesel loco will be procured by different sub groups and nylon bushes required for electric loco will be procured by other sub group). Thus, classification on the basis of industry category is better from procurement point of view.

Procurement is done for each item individually and independently on lump sum basis for each year. This result into long cycle-time and duplication of efforts in finalizing the yearly contract. System of lump sum procurement of all items on year to year basis has certain demerit like, high cycle time, poor responsiveness, high inventory and high stock out situation, repetition of effort of contracting, high cost of procurement due to uncertainty of future business and fixed set up, cost, tooling cost, arms length supplier relation management, poor incentive for innovation and value engineering etc.

Vendor approval by centralized agency is a continuous process. Technical and financial competence of supplier is considered while granting approval but engineering cost estimation of the product is neither discussed nor negotiated. Many times this leads to situation of cartel formation. There are issues of lack of transparency in the product development and source approval. Quality assurance of incoming raw material primarily depends on pre-dispatch inspection of all items. This result in higher inventory in the system, higher cycle time, poor responsiveness and additional cost. Concept of developing process capability and six -sigma are not yet used.

Logistics such as dispatches from vendor to warehouse and warehouse to consumer are arranged on piece meal basis; however, these can be arranged on third party logistics basis (3PL) basis and may result in reduction of inventory. Real-time tracking and optimization of transport resource may provide additional efficiency. If we consider 5% as transport component out of total purchases, then total transport resource requirement is over Rs.1800 crores on yearly basis. Procurement success depends also depends on level of integration. The better the integration of procurement unit within company the better is the overall application of procurement lever. Procurement success depends on cross functional interaction. The better the cross functional interactions of procurement with other unit better the overall application of procurement lever. The integration and cross functional interaction is some what missing in operations of IR.

In the current system the purchase contracts are issued to vendor by various zonal railways with defined delivery scheduled. Time is the essence of these contracts. The vendor is required to supply the material according to prescribed delivery schedules. At times this may result in to excess stock at some place and out of stock at others. Information of stock items is available on system called materials management information systems (MMIS). This information can be shared with vendors and they can be asked to maintain minimum prescribed level of stock at all ordered consignee within the quantity on order and contract period. The contract condition can be suitably modified.

4.9 Supplier Relation Management in Public Procurement

In public procurement environment including the IR the supplier relation is strictly governed by specification of supply, terms and condition of the contract. There is poor incentive on the part of supplier to improve the product design and value engineering. Therefore, supplier contribution in continuous R&D and value engineering effort is very limited. Moreover, due to uncertainty of future orders there is a resistance on the part of supplier to incur investment in developing process capability, improving productivity, improving tooling etc. The basic philosophy of lump sum procurement through competitive bidding is that bidders will offer the minimum possible quality which is meeting the specification. Supplier participation is the key for saving in bill of material (BOM). There are other advantage in long term contract such as lower cost, responsiveness of supplier, and lower inventory etc. Generally it is a myth that long term contract does not fall within the frame work of public procurement environment. Public procurement regulation issued by United Nations Commission on International Trade Law (UNCITRAL) permits framework agreement as acceptable mode of procurement. Public procurement bill placed before the Indian parliaments also allow framework agreement as acceptable mode of procurement. In the framework agreement contract the price revision after finalization of contract can be done in accordance to framework without further competition.

Indian railways data of procurement of stock items for last four year was studied. It is observed that 95% of procurement in value terms is made from approved sources. The significant share of business of these vendors is contributed by the Indian railway. Even though individually the contract are lump sum contracts but overall on IR basis the procurement is made from same set of vendors which means though supplier does not have a long term contract with IR but they have long term business relationship with it. The business with railway has been free from recession so far and there is tremendous potential of growth. Process of vendor approval without considering negotiations on the basis of engineering cost estimation some time creates environment of cartelization, mistrust and corruption. A small improvement can create huge impact in improving efficiency and effectiveness of IR.

5. Conclusions

Area of public procurement is very important from the point of view of its magnitude and objective of spending. Public procurement is estimated as 25-30% of India's GDP and on global scale it is estimated to be 15-20% of the world GDP. Even though the magnitude and importance is so high, this area has not attracted much attention of researchers. There are several avenues for improving theory and practice of supply chain function in the context of public procurement environment.

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