CHAPTER FOUR

INDIAN RAILWAYS PROCUREMENT PROCESS

This chapter discusses procurement process of the Indian Railways. First it analyses typical cycle time involved in the procurement process and makes recommendations for its reduction. It compares public procurement with private procurement and makes recommendations for enhancement of efficiency in public procurement. Then it discusses procurement challenges involved in procurement of tangible items such as items for repair, maintenance, operation and manufacturing activities as well as intangible items such as electrical energy.

4.1 Operations of the Indian Railways

Indian Railways is one of the world's largest public sector organizations and its network, traffic, organization and extent of vertical integration are gigantic. It is the world's largest Railway passenger transport organization, carrying 23 million passengers daily. It is also the world's third largest Railway freight transport organization 115,000 kilometres of track over a route of 66,000 kilometres and 7,100 stations. It manufactures about 250 electric locomotives, 250 diesel-electric locomotives and 3000 passenger coaches annually at six manufacturing units for its own use and for export. Railways workshops manufacture items such as traction motors, switch gears and control gears, cast & fabricated bogies, cast steel railroad wheels and forged axles. It also owns and operates 125 hospitals with a capacity of 14,000 beds. It runs 316 schools for employees" children with enrolments of nearly 100 thousand students. It provides accommodation to about 45 per cent of its nonexecutive personnel and nearly all its executive personnel in 600 thousand apartments owned and maintained throughout the network. It runs mechanized laundries for cleaning bed linen provided on passenger trains and kitchens for preparing food for 9 million passengers travelling daily on long distance trains. Production and maintenance of these assets require uninterrupted flow of large variety of materials which is ensured by material management department.

4.1.1 System of Procurement

Stock Items: The stores department is charged with the responsibility of procurement, storage and issue of stock items used by all other departments of the Indian Railways. Stock items are those items that are regularly required for repair, maintenance, operation and manufacturing

activities and need to be replenished at regular intervals. Unique item code allotted to these stock items is termed as Price Ledger (PL) number. It has eight digits, first two digits signifies major group which represents main assembly. Items are distributed to different purchase groups which are divided according to major Price Ledger group. The stores department also procures non-stock items when requested by the functional departments. Non-stock items are those that do not require regular replenishment and are procured only for a particular activity as and when required.

4.1.2 Stocking Depots

The stores department maintains more than 250 stocking depots spread over the entire Indian Railways network serving various Zonal Railways and Production units. The stocking depots stock 130 thousand stock items of various descriptions. The stocking depots form the basic unit of the materials management organization and are attached to activity centre's such as track maintenance units, loco sheds, carriage and wagon shops, signal repair shops, repair and overhaul workshops and manufacturing units. The stocking depots are responsible for inspection, receipt, storage and issue of the stock materials to the consuming departments. The procurement of the stock items is not done by the stocking depots. Instead, the stocking depots are required to annually raise indents based on estimation of rate of consumption and inventory position to Controller of Stores, through online Material Management Information System (MMIS).

4.1.3 Source Selection Procedure

In order to ensure reliability, availability and safe working of Railway assets, Indian Railways has been following the practice of maintaining lists of approved vendors for certain specific items. The vendor approval process follows sequence of activities as depicted in Figure 4.1. The Railway Board decides the items for which lists of approved vendors are to be maintained as well as the agency responsible for maintaining the lists. The responsibility is mostly given to Research Design & Standards Organization (RDSO) or the manufacturing units. In rare instances the Railway Board might itself decide the approved vendors for certain items

Flowchart on Guidelines for vendor Approval

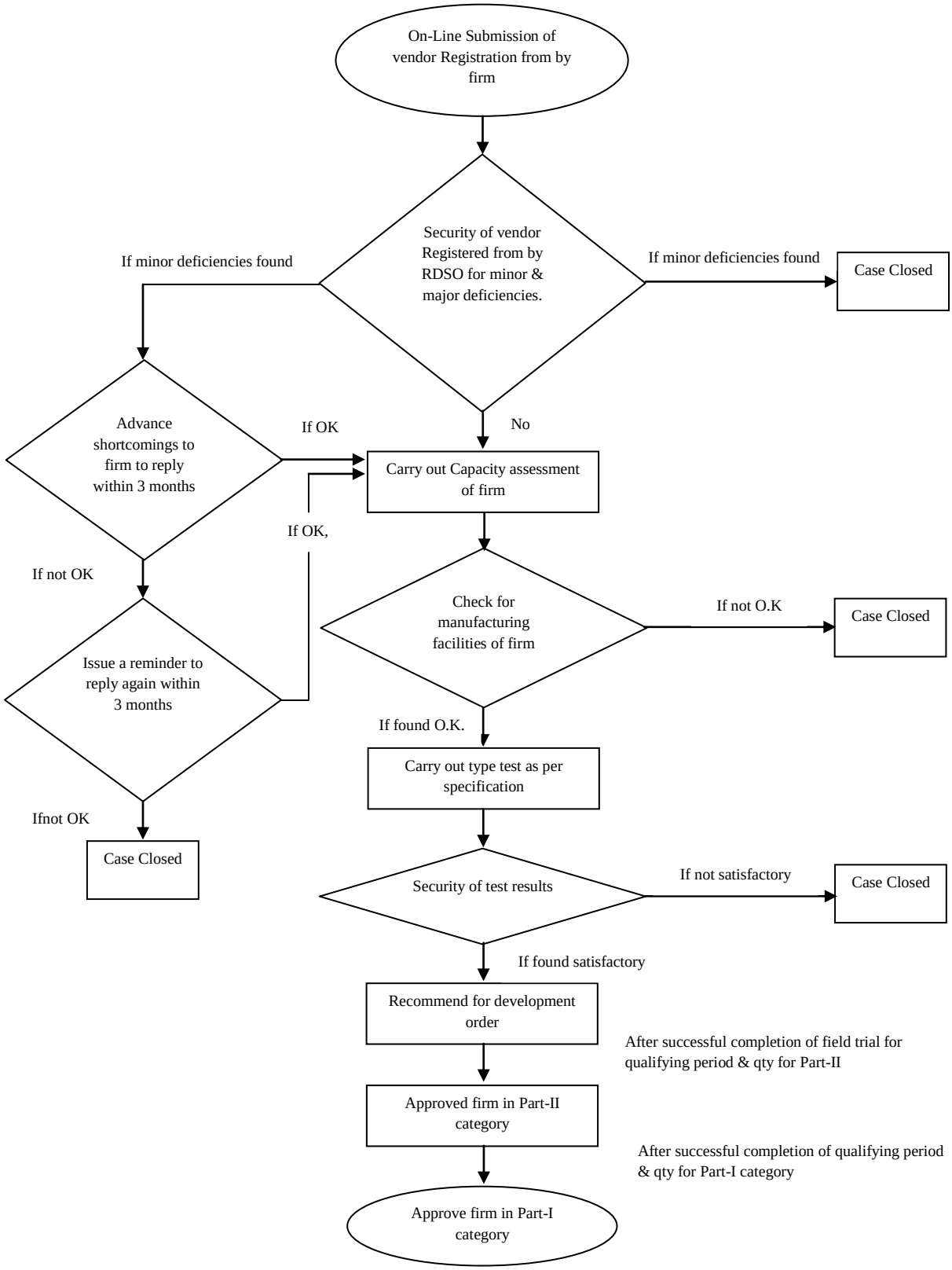


Figure 4.1: Vendor Prequalification and Approval Process
Source: Conceptualized by researcher

Further, certain Zonal Railways or manufacturing units might decide to maintain lists of approved vendors for a few more items (other than those specified by the Railway Board), which in their opinion is critical to maintaining reliability, availability and safe working of assets. Around 75 to 80 percent of procurement in value terms is arranged through prequalified approved groups. Research Design & Standards Organization (RDSO) who is prime vendor approving agency requires that vendors register online for inclusion in the approved vendors list, following which Research Design & Standards Organization (RDSO) examines the firm's financial and technical capacity, infrastructure, manufacturing practices, quality assurance plan etc., through examination of documents and plant visits. If the vendor is found suitable for enlistment, the firm is usually first placed in a Part 2 list; orders for only a limited portion (usually15 per cent) of the procurable quantity. Vendors on Part 2 list are considered for up gradation to the Part 1 list after a minimum period of 15 months from inclusion in Part 2 list. Orders for full tendered quantity can be placed on Part 1 vendors. Vendors can be downgraded from Part 1 to Part 2 in certain circumstances. Vendors once downgraded are not considered for up gradation till at least a year has elapsed. Vendors could also be entirely delisted from Part 1 without process of down grading in certain circumstances. Research Design & Standards Organization (RDSO) publishes the updated list of approved vendors on its website every six months in January and July for use of all the Indian Railways units.

4.2 Procurement Process

Indian Railways procurement process involves performance of various activities via web based e-procurement system running through website www.ireps.gov. Various stages of procurement process involve:

4.2.1 Raising of Indents by Stocking Depots

Calendar of generation of indent called Estimate Sheet is defined on Material Management Information System (MMIS). Mostly annual procurement system is followed. Estimate Sheet for stock items are raised by the stocking depots through Material Management Information System (MMIS) as per predefined schedule. Depending on the type of item inventory control applied for the particular stock item. Two types of inventory control are used in the Indian Railways. In most cases it is fixed interval procurement method and in some cases it is reorder point method. In the fixed interval procurement, indents are sent at periodic intervals for covering the demand over a 12 month period. In the reorder point method, indents are

generated by the stocking depot whenever the inventory level falls to a certain minimum level or the reorder point. Reorder point system is followed for safety or emergency spares.

4.2.2 Tendering Process

Estimate Sheet as well as indents received from the stocking depots are scrutinized and compiled at the Controller of Stores (COS) office. In case the indents are required to be sent to other agencies for procurement, the indents are sent to the accounts department for noting the liability of funds from the budget before sending them to the central agencies of procurement.

4.2.3 Type of Tendering

In case the procurement is to be done by the Controller of Stores (COS) office, decision is taken about the type of tendering process to be adopted. The type of tendering process depends on the nature of the item under procurement and the total estimated value of procurement. The different methods of tendering used are: Open e-tender occurs when tenders are invited by advertisement in media. Procurement is mostly done by the open tendering method under the normal circumstances. Limited e-tender occurs when tenders are invited from a limited number of firms; the value of procurement is less than Rs.10 lakhs and of items for which list of approved vendors has been drawn up. Such limited tenders are also given publicity in media from time to time to seek out vendors who might not be on the approved list but have the capability to supply the material; in such cases, the issue of the tender form is not restricted to firms whose names are on the list of approved contractors. If the offer of firm and credentials submitted are found satisfactory for such firms, a portion of the ordered quantity may be placed with the firm. If the order is satisfactorily executed, the name of the firm is added to the list of approved contractors.

Single tender or private purchase occurs when tender is invited from one firm only. It is used when a specific item such as a spares for a specific machine has to be procured from the original equipment manufacturer only.

4.2.4 The Tender Process

Tender notices, which are generally advertised, include information about the specifications and quantity of items under procurement, place(s) of delivery, time of closing of bid acceptance and opening of bids. The tenders Box is opened electronically jointly by Controller of Stores (COS) office and accounts department representatives on the Indian Railways Electronic Procurement System website www.ireps.gov.in.

A comparative statement of offers, conditions and deviations statement (if any) for all bids is prepared by the Indian Railways Electronic Procurement System instantly and published on Indian Railways Electronic Procurement System portal. The statement is then checked by the accounts department before being sent to the tender committee for consideration of tender. A tender committee comprising representatives from the stores, accounts and user department evaluates tenders valued above Rs.10 lakhs. The committee evaluates the offers and submits its written recommendations (with reasons) to the accepting authority. The accepting authority is usually an executive of the Controller of Stores office; the General Manager is the accepting authority for tender values exceeding Rs.250 million. The accepting authority has the authority to accept, modify or reject the recommendations of the Tender Committee; reasons for not accepting the recommendations of the Tender Committee must be recorded by the accepting authority. Contract is awarded after acceptance of tender.

4.2.5 Inspection, Receipt and Payment

The third party inspection is carried by personnel from specialized agencies such as Rail India Technical and Economic Service Ltd, (a subsidiary consultancy company of the Indian Railways), or Research Design &Standards Organization (RDSO) are generally engaged by the Indian Railways for carrying out such inspections. The vendor usually dispatches the supplies after successful inspection through road transport. The vendor then applies for 95% of total payment along with proof of dispatch and inspection certificate. On an average payment is made within a fortnight after submission of bill.

4.2.6 Receipt & Payment

The consignee stocking depot on receipt of the supplies will carry out inspection of material before acceptance and if everything is as per specification then he will intimate the Controller of Stores (COS) office and accounts personnel designated to make payment in a standard form, the date of supply, along with details of quantities received, rejected or accepted. It is seen that multiple agencies are involved in the procurement process: the indenting unit, the Controller of Stores office, the user department, the accounts department, Research Design &Standards Organization (RDSO) and Rail India Technical and Economic Service Ltd. It is also observed that the Indian Railways Accounts department maintains oversight on procurement issues through financial scrutiny of all procurement proposals, participation in the tender process and payment. The associated accounts department also conducts regular

checks on stocking depot to verify whether the physical inventory matches that in the records. The accounts department of the Indian Railways is uniquely positioned for this role of supervision, since it is different from the other functional departments. The role of the accounts department is to protect the financial interests of the Government of India; the objective being to secure maximum efficiency in Railways operations at the minimum cost, without unduly sacrificing one for the other. The Financial Commissioner, who heads the accounts department at the Railway Board level, is also a representative of the Finance Minister in the Indian Railways. The Financial Commissioner is thus the only Board Member who can differ with the Chairman of the Railway Board. The Financial Advisor & Chief Accounts Officer (FA&CAO) (Functional Head of the Accounts Department at Zonal Railway level) is again the only functional head who can differ with the General Manager's instructions.

4.3 Private Procurement versus Public Sector Procurement

Professionally managed large private organizations mostly carryout strategic sourcing. Adaptations of its best practices in the public sector require first to have a comparison between the Supply Chain Management (SCM) in the public sector and private sector. First and foremost is a requirement for transparency. Transparency implies predictability and rule of law. In Government transparency exists when all information is openly and freely available. In public sector procurement, this means that the procurement process, rules, and transactions must be spelled out and available to the public as well as to potential suppliers. This requirement affects such areas as advertising of the contract opportunity, the public tendering process, and the awarding of the contract. Moreover, all suppliers must be treated the same regarding access to information, specifications, and the amount of time they have to respond to a bid. Pricing is public information and bid openings are public events where bidders are notified about the summary of all bids received.

Public sector procurement professionals often must work under strict rules regarding award of contract. Public procurement professionals can utilize "*approved suppliers*" that have passed through the process of vendor approval. People's skill sets often are different in public and private sector supply chains. A recent study by the McKinsey & Company and the Institute for Supply Management showed that public sector procurement professionals lag behind private sector companies on several performance dimensions, including efficiency of purchasing tools and processes, capabilities, and performance management. One reason for

this disparity is that mastering supply chain management requires integrated perspective and streamlining of processes. Yet many public organizations have not invested in the necessary training to keep SCM professionals up to date, forcing them to focus on what to do rather than on how to think. It is only in the last decade or so that private sectors best practices have been introduced to the public sector supply chain managers. However, because public organization are under increasing pressure to reduce costs, more supply managers are now seeking outside training and knowledge that will help them to improve their operations.

Despite the real and perceived differences, public and private supply chains are alike in three important ways: First, they share a common goal: to obtain the best value for the organization. This means getting the most from each rupee at every step in the Supply Chain (SC). In the public sector spending efficiency equals organizational efficiency; this applies not just to purchasing but to the entire supply chain (SC). Second customers continue to demand better quality, faster service, and lower cost. This is as true for public sector supply chains as it is for the private sector, especially in light of the current public backlash against the cost of government. Accordingly, public sector officials are placing a new emphasis on cycle-time compression and speeding up the SC, from procurement to delivery. Balancing this demand against the requirements for transparency presents a unique challenge for the public sector. Third the new reality is that all supply chains are pressured to provide more (materials, services, information, and so forth) in an environment of continually dwindling resources.

Another way that public and private sector supply chains are similar is that they are both subject to three trends that are driving change. Both supply chain models require total process visibility if they are to increase the speed of sourcing, drive down the cost of inventory, and improve the cash-to-cash cycle. Visibility promotes fact-based decision making and removes the excuses for making poor decision by replacing anecdotes and conjecture with informational certainty. Driving costs out of private sector supply chains has been a priority for a generation of supply chain professionals. The reality for public sector supply chain managers is that they, too, need to eliminate costs from the supply chain to ensure their organizations‟ long-term viability. Both public and private sector supply chains must become more agile. In a world where continuous improvements in communication and technology lead to shorter shelf lives for many products, supply chains have the increasingly difficult job of maintaining a relevant portfolio of materials and services while avoiding the losses caused

by holding obsolete material. Material liquidation is an industry that exists because of supply chain inefficiency. Agility keeps obsolescence to a minimum.

Both types of supply chains must have transparency. Transparency, however, is not just about rules, regulations, and filling out forms. It is also about ethics in business relationships. Ethics and proper decorum in business relationships allow organizations to simultaneously collaborate and be competitive. It is possible, moreover, for both public and private supply chains to have a business relationship based on trust and sharing information that rewards innovation and productivity improvement through shared savings agreements. In some ways, directives of public sector supply chains are not very different from their private sector counterparts. Public sector customers demand that materials and services be delivered with the speed and cost structure of the private sector, and public sector supply professionals are struggling with how to accomplish that. It can be done by using private sector principles such as strategic sourcing in a way that is acceptable in public sector settings. Let's take a look at those principles and some recommendations for how to successfully apply them in the public sector.

4.3.1 Public Procurement

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

4.3.2 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).

Public procurement as per the Indian Public Procurement Bill (2012) and revised Public Procurement Bill (2015) involves acquisitions by purchase, lease, license or otherwise of

goods or service or any combination there off 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, procurement through multi-lateral funding or any entity where more than 50 per cent equity is held by Government including procurement under public private partnership 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 (PP) 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 Crores (US $300 Billion) which amounts to 25 to 30 per cent of the nation's GDP. A mere saving of few percents would result in substantial amount which can be channelized 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.

4.3.3 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, life cycle cost, total cost of ownership concept, right source, right time and place, right and ethical method.

4.3.4 Difference in Public and Private Procurement

The Public and Private Procurement various 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, 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 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 shareholders, 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 per cent to 70per cent 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.

4.5 Evolution of Supply Chain Function in the Indian Railways

Our last 50-60 years material management function has evolved tremendously. In 1940-50 the head of Material Management function in an organization was designated as Chief Store Keeper. 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 Material Management 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 Material Management 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 Chief Store Keeper to Supply Chain Manager, the role of material manager in the Indian Railways is between that of Chief Store Keeper and Material Management. In the Indian Railways, value engineering and vendor development are done by Research Design &Standards Organization (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 schematic diagram in Figure 4.2.

For comparison the supply chain of a Leading Automobile Company has been 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 2 hours, stocks out situation are very rare and the procurement managers of Leading Automobile Company are given a target of reduction in Bill of Material by 7% on year-to-year basis. This reduction in Bill of Material is possible by amortizing the fixed cost on the life cycle basis and joint value engineering efforts by the buyer and the supplier. Total numbers of active vender's are in range of 290 only

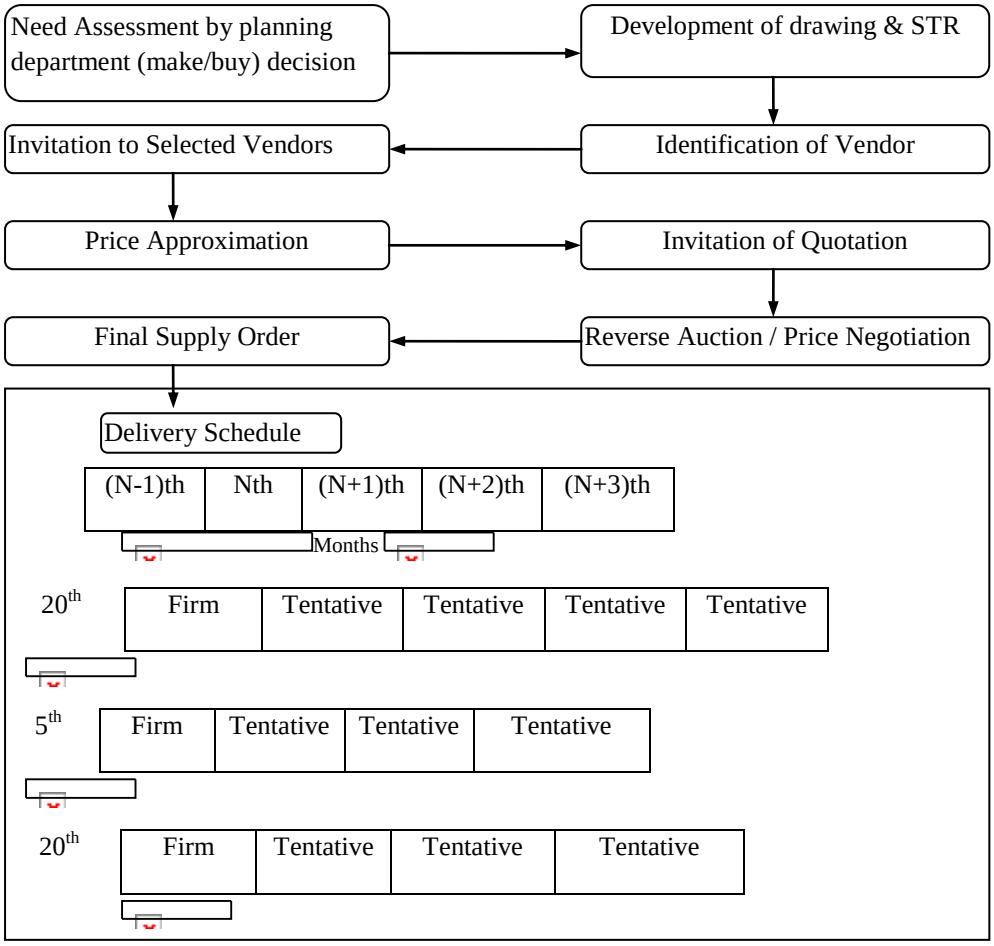


Figure 4.2: Framework of Inbound Supply Chain of a leading Automobile Company
Source: Developed by researcher

4.6 Frame work of Procurement in 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 Price Ledger No (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. Figure 4.3 depicts typical cycle of procurement process of the Indian Railways and Figure 4.4 depicts a typical procurement cycle

time.

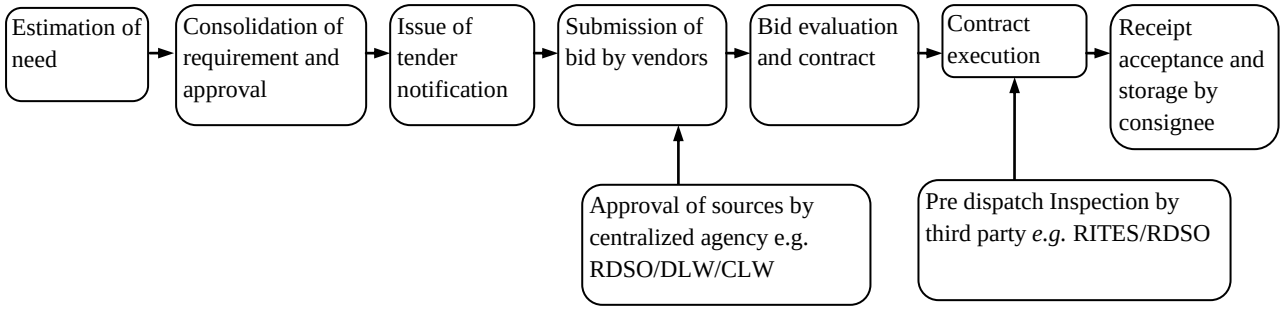


Figure 4.3: A Typical Cycle of Procurement Process of Indian Railways
Source: Conceptualized by researcher

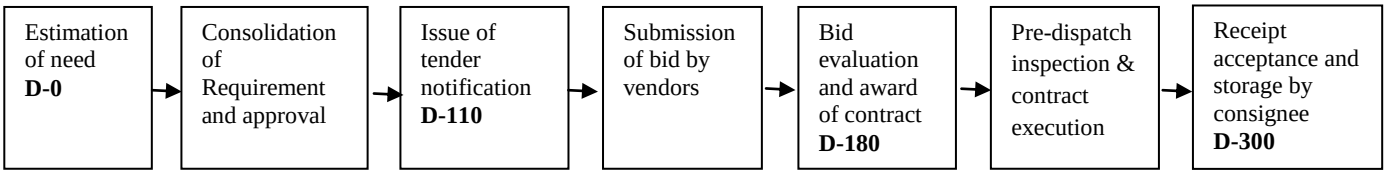


Figure 4.4: A Typical Procurement Cycle Time of the Indian Railways
Source: Conceptualized by researcher

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 department. It is observed from last 4 year purchase data that most of the items (80%) in value terms are procured through approved sources. Significant share of business of Railways approved sources is contributed by Indian Railways. Approval of sources is done by centralized agency such as Research Design and Standard Organization (RDSO); Diesel Locomotive Works or Chittaranjan Loco Works etc. While approving the sources the engineering cost estimation of items is not the consideration. Only technical and financial capability is taken into considerations. Suppliers are required to arrange inspection of all consignments from 3rd party inspecting agency like Rail India Technical and Economic Services Ltd or Research Design &Standards Organization (RDSO) prior to dispatch of material. Source approving agency, procuring agency and inspecting agency are independent to each other. Material is finally received and accepted by consignee who is warehouse in charge 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. Table 4.1 compares typical Key Performance Key Indicators (KPIs) of Indian Railway's procurement cycle with that of a leading automotive company which is operation using best in class procurement practices.

Table 4.1:Comparision of KPIs for Procurement Cycle

SN	**Key Performance Indicators**	**Public Actor**	**Private Actor**
		Indian Railways	**Leading Automobile Company**
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
	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. Physicalinventory 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 delivery period extention	>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 bill of material (BOM)	5 % increase in a year is generally considered as resanable	(-7%) reduction in bill of material per annum

Source: Data compiled by researcher

4.6.1 Challenges in Business Process of Inbound Supply Chain of the Indian Railways

System of codification of items requires that each item should have unique item code. On the Indian Railways 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 from 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 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 for developing expertise of trade and economy of scale. For each year procurement is performed for each item individually and independently on a lump sum basis which results into long cycle time as well as duplication of efforts leading to delay in finalization of 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, arm's length supplier relation management, poor incentive for innovation and value engineering etc.

Vender 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 quality control using six-sigma concepts 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 (3PL) basis and may results in reduction of inventory. Real-time tracking and optimization of transport resource may provide additional efficiency. If we consider five per cent as transport component out of total purchases, then total transport resource requirement is over Rs.2000 Crores on yearly basis. Procurement success 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 somewhat missing in operations of the Indian Railways. 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. This creates the foundation of Vendor Managed Inventory (VMI) in Public Procurement Environment.

4.6.2 Supplier Relation Management in Public Procurement

In public procurement environment including the Indian Railways 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 Research &Development (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. 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 the United Nations Commission on International Trade Law permits framework agreement as acceptable mode of procurement. Public Procurement Bill placed before the Indian parliaments also allows 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 five year was studied. It is observed that 95 per cent of procurement in value terms is made from approved sources. The significant share of business of these approached vendors is contributed by the Indian Railway. Even though individually the contract are lump sum contracts but overall on the Indian Railways basis the procurement is made from same set of vendors which means though supplier does not have a long term contract with the Indian Railways but they have long term business relationship with it. The business with Railways 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 the Indian Railways.

4.7 Case Study I: Procurement of High Speed Diesel in the Indian Railways

4.7.1 Background

The purchase system of petroleum oil and lubricants was studied from old files in the Railway Board, New Delhi. It is found that the purchase of petroleum oil and lubricants products for the requirement of Indian Railways was decentralised by Directorate General of Supplies & Disposals (DGS&C) in 1990 and centralised procurement of Petrol Oil and Lubricant (POL) products for the Indian Railways was started in Railway Board. The first rate contract for the primary oils, prices of which were governed by the Government's Administered Price Mechanism, at that time, was concluded by the Railway Board on 21.10.1991 with the 3 Public Sector Units namely M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd (BPCL)& Hindustan Petroleum Corporation Ltd. (HPCL), for one year, i.e. from 01.10.1991 to 30.09.1992. In view of continuation of Administered Price Mechanism by the Ministry of Petroleum for High Speed Diesel (HSD), the rate contracts concluded in 1991 with 3 Public Sector Units (PSUs) were extended from year to year till 2002.

Thereafter, Ministry of Petroleum vide their letter No.P/20029/5/2002-PP dated 12.03.2002 advised that the pricing of petroleum products will be market determined post 01.04.2002. Under the changed scenario, it was decided to float an open tender to conclude rate contract for High Speed Diesel (HSD). Subsequently contracts were placed on oil Public Sector Units and for some limited number of Railways Consumer Depots on Reliance Industries Ltd., and Mangalore Refinery and Petrochemicals Ltd. The advertised tender was floated for the contract period 01.01.2003 to 31.12.2003 and the rate contracts were concluded with three central Public Sector Units i.e. M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd (BPCL)& Hindustan Petroleum Corporation Ltd (HPCL). For the contract period 1.1.04 to 31.12.04, regular rate Contracts for High Speed Diesel (HSD) were concluded with M/s Indian Oil Corporation Ltd (IOC), Bharat Petroleum Corporation Ltd (BPCL)& Hindustan Petroleum Corporation Ltd (HPCL), and a trial rate contract was also concluded with M/s Reliance Industries Ltd. by allotting them 3 Railways Consumer Depots. For the contract period 1.1.2005 to 31.12.2005, regular contracts were concluded with M/s Indian Oil Corporation (IOC) Ltd, Bharat Petroleum Corporation Ltd (BPCL) & Hindustan Petroleum Corporation Ltd (HPCL),& M/s Reliance Industries Ltd., and trial rate contract was concluded with M/s Mangalore Refinery and Petrochemicals Ltd. For contract period 1.1.2006 to 31.12.2006, 1.1.07 to 31.12.07 and 1/1/08 to 31.12.08 regular rate contracts were

concluded with M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd (BPCL) and Hindustan Petroleum Corporation Ltd (HPCL) and M/s Mangalore Refinery and Petrochemicals Ltd. The rate contracts on M/s Mangalore Refinery and Petrochemicals Ltd., were to be operated only for limited Railways Consumer Depots(RCD) locations more than 10 years old after payment of annual usage charges. For contract period 1.1.2009 to 31.12.2009 regular rate contract was concluded with 3 Public Sector Units namely M/s Indian Oil Corporation Ltd (IOC), Bharat Petroleum Corporation Ltd (BPCL) and Hindustan Petroleum Corporation Ltd (HPCL). For contract period 1.10.2010 to 31.12.2011 regular rate contracts were concluded with M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd & Hindustan Petroleum Corporation Ltd on 29.9.2010. The rate contracts concluded on 29.9.2010 with 3 PSUs were extended for one year i.e. up to 31.12.2012. For contract period 1.1.2013 to 31.12.2013 regular rate contracts were concluded with M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd (BPCL) and Hindustan Petroleum Corporation Ltd (HPCL) on 24.05.2013, extendable by one year at Railway's option and further extendable for one more year at mutual agreement.

For meeting the requirement of High Speed Diesel (HSD) Oil, the Indian Railways had been concluding rate contracts. Supply orders against these rate contracts are placed by Zonal Railways for various consignees. For this purpose, "bulk storage-cum-dispensing facilities" have been set up at various locations by three Public Sector Units oil companies, namely M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd (BPCL) and Hindustan Petroleum Corporation Ltd (HPCL). These facilities known as Railways Consumer Depots have been provided by the above companies free of cost on assurance of off take guarantee. The responsibility for maintenance of Railway Consumer Depots (RCD) also rest with the oil companies. For supply of product, Railways generally prefer allocation of Railways Consumer Depots (RCD) to the firm that had initially set up the facility for obtaining supplies as per rate contract terms.

After the assured off take quantity is drawn from a Railways Consumer Depots (RCD), Railways are free to allocate the Railways Consumer Depots (RCD) to any of the firms on payment of specified annual storage charge and on getting the undertaking for long term maintenance. However, above three oil Public Sector Units (PSU) continue to be the traditional suppliers of High Speed Diesel(HSD) to Indian Railways. In the past, few firms namely, Reliance Industries Ltd., and Mangalore Refinery and Petrochemicals Ltd., a

subsidiary of Oil and Natural Gas Corporation (ONGC), evinced interest in securing rate contracts and accordingly some rate contracts were concluded with them for a limited number of Railways Consumer Depots (RCD), on a trial basis. Regular rate contracts was concluded with M/s Reliance in year 2005 against which some supplies were made, however in year 2006, after conclusion of rate contract, Reliance Industries Limited and Mangalore Refinery and Petrochemicals Ltd., could not execute contract. All the three Public Sector Units oil marketing companies i.e. M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd & Hindustan Petroleum Corporation Ltd., issue master price list every fortnight, which normally indicate same price for various locations. However, to safeguard Railways interests, the contract has a clause stipulating that minimum of the three Master Price List price shall be payable to the oil companies. Thus the oil companies are virtually being paid at price ruling on the date of supply. For contract period 1.1.2013 to 31.12.2013, regular rate contracts were concluded with M/s Indian Oil Corporation (IOC) Ltd, Bharat Petroleum Corporation Ltd (BPCL) and Hindustan Petroleum Corporation Ltd (HPCL)., on 24.05.2013.These rate contracts were valid for one year, extendable by one year at Railway's option and further extendable for one more year with mutual agreement.

4.7.2 Tendering & Qualifying Requirement

Some of the important conditions included in the tender documents are as under:

Free Bulk Storage-Cum-Dispensing Facilities (applicable for supplies in bulk only)

The oil companies should specify the minimum quantity of Primary oil products required to be procured (over a time frame) from them against which they agree to provide a bulk storage cum dispensing facility free of cost at location, to be decided by the Railways. After the supply of specified quantity of primary oil High Speed Diesel (HSD), this facility will become the property of Railways without any further binding to use this facility for storage of only the Company's product, which has provided it (Clause 18 of "Instructions to Tenderers).

4.7.3 Maintenance of Bulk Storage and Dispensing Installations

The Railways would prefer allocation of Railway Consumer Depots (RCD) to the firm at such locations from where supplies are being drawn by virtue of having provided bulk storage and dispensing facilities or have been traditionally supplying for the past many years or have agreement for supplies. However, Railways can allot such Railways Consumer Depots(RCD) which are free from assured off-take guarantee to any of the firm as deemed fit

with provision of adequate safeguard by taking an undertaking of long term maintenance of Railways Consumer Depots (RCD) along with a covering bank guarantee of adequate value i.e. equal to 3 years annual usage charges so as to cover the major repair expenditure if firms do not attend the Railways Consumer Depots (RCD) properly due to short term business consideration.

In the event of inadequate maintenance by a firm or refusal to do so, the Bank Guarantee can be forfeited by the Zonal Railways. Firm on whom rate contract will be placed will undertake, the proper maintenance/repair of the storage-cum-dispensing installations/facilities including change of tank if necessary, at their cost, to the entire satisfaction of the consignees. Such maintenance will also include their replacement/renewal of accessories like motors, pumping units, impellers, valves and spare parts of the flow meters in the event of their normal wear and tear. The Zonal Railways, however, shall ensure the safe handling of the equipment's and avoid any damage and loss due to negligence, theft etc.

4.7.4 Annual Usage charge

The oil companies will be required to put up free bulk storage-cum-dispensing facilities as per clause 18 of "Instructions to tenderers". However, if an oil company is allowed to supply to a Railways Consumer Depots not installed by them and in that case, for using such facilities, they will be required to pay an "Annual Usage Charges" of Rs.9,50,000/- for tankage up to 140 kl and Rs.661/- per kl for additional tankage.

4.7.5 Qualifying Requirements for Tender

The tenderers shall provide satisfactory evidence acceptable to the Purchaser to show that he is licensed manufacturer who regularly manufactures the items offered and has adequate technical knowledge and practical experience, he has adequate financial stability and status to meet the obligations under the contract for which he is required to submit a report from a recognised bank or a financial institution, he has adequate plant and manufacturing capacity to manufacture and supply the items offered within the delivery schedule offered by him, he has an established quality control system and organisation to ensure that there is adequate control at the stages of all manufacturing process.

For purpose of above, the tenderers should additionally submit a performance statement, giving a list of major supplies effected in the recent past, for the items offered by him, giving

details of the purchaser's name and address, order no. and date and the quantity supplied and whether the supply was made within the delivery schedule. A statement indicating details of production capacity and equipment employed and quality control measures adopted. In addition to the above, further information regarding his capacity/capability, if required by the Purchaser shall be promptly furnished by the tenderers. The tenderers not submitting the requisite information may note that their offer is liable to be ignored.

4.7.6Price Variation Clause

Tenderers are required to quote on firm price basis. However, if variation in price on the finished store is desired, it may be considered provided a well-defined formula for the same is given. The variation then will be applicable both ways i.e. increase or decrease. The documentary evidence for the base rates (Rupees per kilometre in bulk) adopted should be indicated in the offer. If the tenderers does not specifically request for variation in the price of stores, price variation clause may not apply and the price quoted may be considered as firm, notwithstanding any increase on any account.

Issuing a tender though this process and subsequently opening it on 06.11.2013 found that offers were received from the following firms:

M/s Bharat Petroleum Corporation Ltd.,

M/s Essar Oil Limited

M/s Hindustan Petroleum Corporation Ltd.,

M/s Indian Oil Corporation Ltd.,

M/s Reliance Industries Ltd.

For meeting the requirement of High Speed Diesel Oil, Indian Railways had been concluding rate contracts. Till last tender, all the firms including M/s Reliance, Mangalore Refinery and Petrochemicals Ltd and the three Public Sector Unit Oil Marketing Companies have been quoting a single rate based on Master Price List with some discount. All the three Public Sector Unit companies issue Master Price List every fortnight for each supply location. Even though the contract has a clause that lowest of the three Master Price List price shall be paid, normally all three Public Sector Units have been issuing Master Price List at same pricing mechanism indicating same prices.

4.7.7 Deliberation on Pricing Mechanism

Earlier all bidders were submitting price bids based on single parameter i.e. Master Price List with some discount over and above Master Price List. This time, there were three sets of offers. M/s Essar and Reliance have quoted their own pricing formula. First and lowest firm M/s Essar has quoted with Price Variation Clause (PVC) based on Refinery Transfer Price with their price as (Refinery Transfer Pricing) + 200 with taxes, duties and freight extra.

M/s Reliance has quoted their price with Price Variation Clause (PVC) based on Platts chart. To take care of supplier's costs and margins, they have quoted sale location wise "k" factor for different locations.

The three Public Sector Unit oil marketing companies (M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd & Hindustan Petroleum Corporation Ltd.,) have continued with their earlier practice i.e. they have quoted as per Ex-storage Point Price used to calculate Master Price List of different supply locations, without any discount.

As per Ministry of Petroleum and Natural Gas (MOPNG) Trade Parity Pricing is computed as weighted average price of Import Parity Price (IPP) and Purchase Parity (PP). The weight assigned to IPP is 80% and the weight assigned to Export Parity Price(EPP) is 20% for computing Trade Parity Price. It is pertinent to note that Trade Parity Price is same as Refinery Transfer Price. M/s Reliance Industries Ltd., pricing was not in compliance with this policy.

M/s Essar has quoted PVC formula based on Refinery Transfer Price which is acceptable as per Government policy of Diesel pricing. Further Public Sector Unit oil Companies M/s Indian Oil Corporation Ltd, Bharat Petroleum Corporation Ltd & Hindustan Petroleum Corporation Ltd., have quoted single Ex-Storage Point price which is actually extension of Refinery Transfer Price based pricing mechanism. It may be noted that Ex-Storage Point price is sum of weighted average Refinery Transfer Price, Net weighted average freight and logistics & marketing cost/margins. Refinery Transfer Price for all refineries is published for each fortnight.

Contract is finally placed on all three Oil Public Sector Units and for some locations to Reliance Industries Ltd., and Essar.

Issues with Supply Chain of High Speed Diesel

Railway Board enters into running contract with oil companies. The Controller of Stores of Zonal Railway places withdrawal order of annual requirement on Oil Company as per the contract placed by Railway Board. These oil companies maintain installations called Railway Consumer Depots (RCD) at strategic important locations. Railway Consumer Depot (RCD) maintenance is done by oil company. A Railway supervisor and some helpers are posted on each Railway Consumer Depot (RCD) for its operation, receipt, accountal and issue of High Speed Diesel. Railway Consumer Depots have tankage capacity equivalent to 15 days to 30 days consumption. Railway maintains 7 to 30 days inventory at each Railway Consumer Depot (RCD). When stock reaches the prescribed minimum level, a memo is issued by railway supervisor to oil company for supply. Flow chart for High Speed Diesel recoupment accountable and issue is shown in Figure 4.4

High Speed Diesel (HSD) is recouped within 2 to 3 days. 100% availability at all time is ensured. The average inventory of High Speed Diesel (HSD) oil is 10 days consumption. Issues with the current practices: High inventory: Average inventory of 10 to 15 days

High Manpower: Roughly 4500 employee are posted to handle operations at 250 Railway Consumer Depot (RCD) installations over all the Indian Railways.

The ownership of inventory and handling losses are on Railway's account. Railway has to bear handling losses which is permitted up to 0.1% of total transaction. There is possibility of pilferage and theft.

Total annual consumption of High Speed Diesel (HSD)oil on Indian Railways is roughly 2.8 billion litres. High Speed Diesel is subjected to State Sales tax which varies from 7.5% in the State of Rajasthan to 26% in the State of Maharashtra.

There are three Railway Consumer Depots (RCD)in Mysuru Division of South Western Railway.

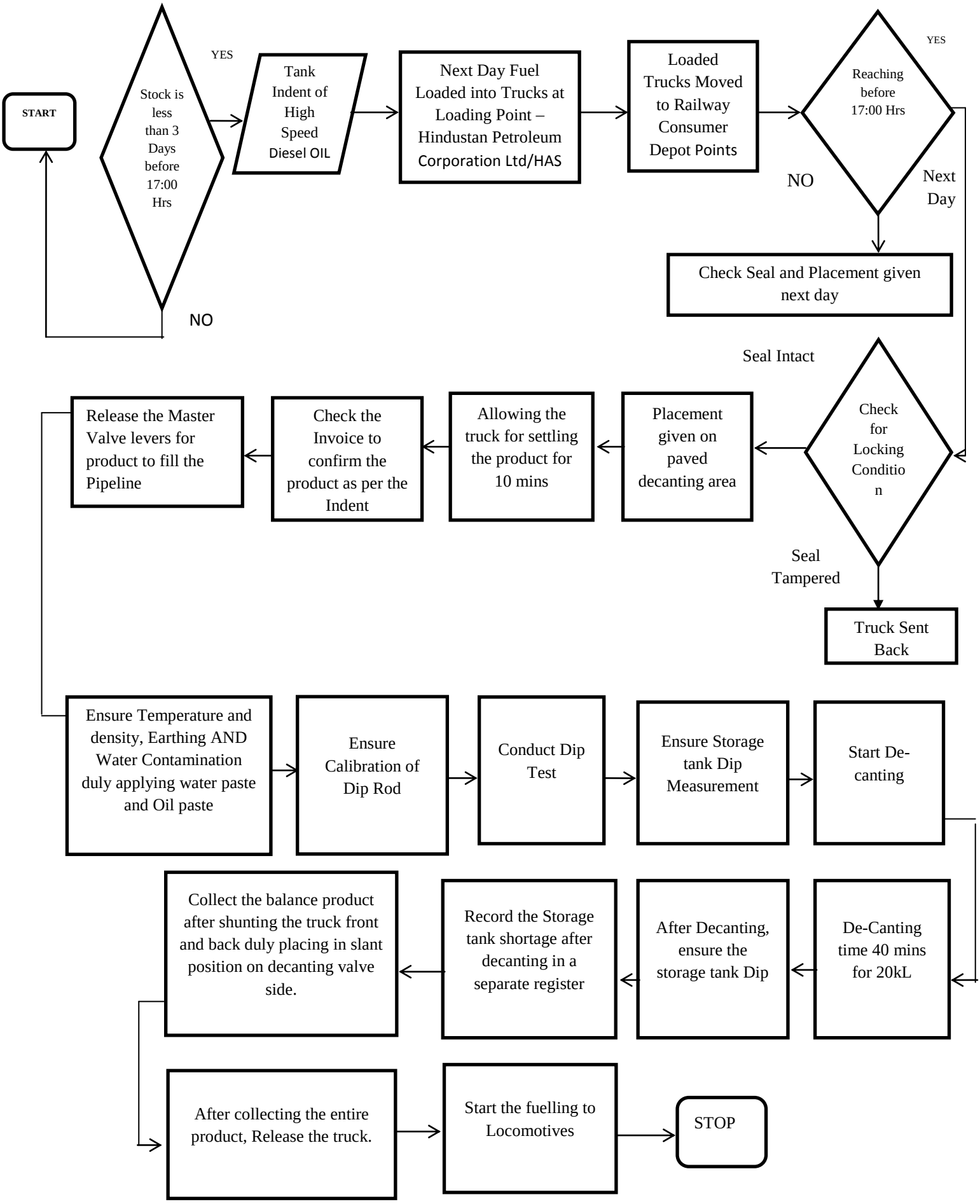


Figure 4.5: Flow chart for High Speed Diesel recoupment, accountal and issues
Source: Conceptualized by researcher

Operations of these Railways Consumer Depots are depicted in Table 4.2.

Table 4.2: Diesel Consumption Profile (Mysuru Division of South Western Railway)

Railway Consumer Depot Arsikere											
Year	Opening Balance	Receipts in Lts	Total in Lts	Total issues in Lts	Closing balance in Lts	Ground Balance in no of days	Ground balance in Lts	Handling loss in Lts	% age	No.of Locos fuelled	No.of staff deployed
	A	**B**	**D=(A+B)**	**C**	**F=(D-C)**	**E/(C/365)**	**E**	**G=(E-F)**	**(G/C) x 100**		
2013-14	916637	19515354	20431991	19584750	847241	15.67	840667	-6069	-0.03%	9490	15
2014-15	839315	19274092	20113407	19357812	755595	14.07	746064	-9531	-0.05%	9125	15
2015-16	747796	21058776	21806572	21383200	423372	7.11	416502	-6870	-0.03%	9088	15
Railway Consumer Depot Chickjajur											
Year	Opening Balance	Receipts in Lts	Total in Lts	Total issues in Lts	Closing balance in Lts	Ground Balance in no of days	Ground balance in Lts	Difference in Lts	% age	No.of Locos fuelled	No.of staff deployed
	A	**B**	**D (A+B)**	**C**	**F (D-C)**	**E/(C/365)**	**E**	**G (E-F)**	**(G/C) x 100**		
2013-14	240993	9174212	9415205	9032250	382955	15.28	378032	-4923	-0.05%	4015	8
2014-15	378032	11307191	11685223	11195616	489607	15.74	482943	-6664	-0.06%	3942	9
2015-16	482943	8447865	8930808	8649350	281458	11.67	276466	-4992	-0.06%	3978	8
Railway Consumer Depot SKLR											
Year	Opening Balance	Receipts in Lts	Total in Lts	Total issues in Lts	Closing balance in Lts	Ground Balance in no of days	Ground balance in Lts	Difference in Lts	% age	No.of Locos fuelled	No.of staff deployed
	A	**B**	**D (A+B)**	**C**	**F (D-C)**	**E/(C/365)**	**E**	**G (E-F)**	**(G/C) x 100**		
2013-14	478555	13019524	13498079	13052050	446029	12.23	437187	-8842	-0.07%	3832	12
2014-15	437187	12294251	12731438	12118500	612938	18.25	606044	-6894	-0.06%	3759	12
2015-16	606044	7911510	8517554	8276100	241454	10.29	233319	-8135	-0.10%	3723	12

Source: Data Compiled by researcher

4.7.8 Fuel Management System at a Division

Mysuru Division consists of Three Railway Consumer Depot depots, i.e. *Arsikere*, *Chickjajur* and *Sakleshpur*. These depots are catering the fueling requirement of the entire division. Sakleshpur depot is feeding freight trains only. *Chickjajur* and *Arsikere* are feeding Express/Passenger Trains.

Arsikere (Karnataka)

Indian Oil Corporation Ltd Maintains the Railway Consumer Depot. There 20 points are available to issue fuel to the loco's running on UP/DOWN lines. *Arsikere* depot is nominated for blending of BIO-diesel. 142 kl capacity is made ready for the storage of B-100 (BIO-DSL). The Controller of Stores of the fuel is less when compared to other divisions. The

freight trains passing through Arsikere is being fueled at *Arsikere*. The details of storage and other issues are furnished below.

Table 4.3: Description of a typical Diesel Fuelling Station at Arsikere, Karnataka

Description	Parameters	Remarks
Capacity Tank- I	142 KL (kilo litre)	Storage of B-100
Capacity Tank- II	252 KL (kilo litre)	Storage Blended Oil
Capacity Tank- III	575 KL (kilo litre)	Storage of High Speed Diesel Oil
Maintained by	M/s Indian Oil Corporation	
Average Issues	60 KL/Day	Passenger/Freight Trains
Loco fuelled per day	27 Locos	
Clerks	1 Sr.Clerk	For Managing Fuel Accounts
C&W Staff working in Railway Consumer Depot	14	For Decanting/Fueling of Locos

Source: Data Compiled by researcher

Sakleshpur (Karnataka)

Bharat Petroleum Corporation maintains the Railway Consumer Depot (RCD). There are 06 points available to issue fuel to the loco's running on UP/DOWN lines. Out of 06 points, 2 points towards Hassan end is suspended due to defective flow meters. The freight trains passing through *Sakleshpur* is being fuelled. There are works like calibration of flow meter, changing of HUDCO valves and filters pending by Bharat Petroleum Corporation Ltd (BPCL). The works are in progress. The details of storage and issues are furnished below.

Table 4.4: Description of a typical Diesel Fuelling Station at Sakleshpur, Karnataka

Description	Parameters	Remarks
Capacity Tank- I	330 KL (kilo litre)	Storage of High Speed Diesel Oil
Capacity Tank- II	330 KL(kilo litre)	Storage of High Speed Diesel Oil
Maintained by	M/s Bharat Petroleum Corporation	
Average Issues	24 KL/Day	Freight Trains
Loco fuelled per day	14 Locos	
Clerks	1 OS	For Managing Fuel Accounts
C&W Staff working in Railway Consumer Depot	11	For Decanting/Fueling of Locos

Source: Data Compiled by researcher

Chickjajur (Karnataka)

Bharat Petroleum Corporation maintains the Railway Consumer Depot (RCD). At present there is only 02 points available to issue fuel to the loco's running on UP/DOWN lines. After

modifying the yard plan it is proposed to add 14 more points. The proposed work is pending, as the modified plan is yet to receive from the operating branch. The details of storage and issues are furnished below.

Table 4.5: Description of a typical Diesel Fuelling Station at Chickjajur, Karnataka

Description	Parameters	Remarks
Capacity Tank- I	250 KL (kilo litre)	Storage of High Speed Diesel Oil
Capacity Tank- II	250 KL (kilo litre)	Storage of High Speed Diesel Oil
Maintained by	M/s Bharat Petroleum Corporation	
Average Issues	26 KL/Day	Freight Trains
Loco fuelled per day	16 Locos	
Clerks	1 OS + 3 Jr Clerks	For Managing Fuel Accounts, Fuelling of Locos
C&W Staff working in Railway Consumer Depot	04	For Decanting/Fuelling of Locos

Source: Data Compiled by researcher

4.7.9 Vendor Managed Fuel Management System at Karnataka State Road Transportation Corporation (KSRTC), Bannimantapa, Mysuru.

The depot is being maintained by Bharat Petroleum Corporation Limited (BPCL). High Speed Diesel (HSD) is being supplied from Bharat Petroleum Corporation Ltd (BPCL).

There are 3 tankers available in the depot. All the tankers are having sensor. These sensor gives following data in real time basis:

Fuel stock on hand.

Temperature/Density.

Water content in the oil of the tank.

The depot is maintaining inventory of 2 days balance, i.e. nearly 24 KL. The daily average issue is 12 KL approximately.

The fuel issuance is computerized. Every bus is given one Radio Frequency Identification (RFID) and each BUS driver is also given Radio Frequency Identification (RFID). While issuance of fuel, the token carrying Radio Frequency Identification (RFID) related to the bus and related to the driver is recognized by the fuel dispensing unit. Only after that fuel is issued.

The fuel dispensing unit is synchronized. The stock balance automatically gets deducted. But wise and driver wise fuel consumption data also gets generated.

The stock balance in fuel tanks are physically verified at stipulated period and it is also cross checked with the electronic stock availability. It is always found matching.

The Fuel Management System (FMS) is web based, daily issues stock availability, can be seen on internet. Based on consumption trend and stock availability the supplier can take replenish decision, thus the system inventory becomes vendor managed.

Applicability to the Indian Railways

The railway may also get it implemented in parallel to the existing system.

It may be proposed to adopt it in Mysuru Division, as the fuel depot of this division has very less interfacing with loco pilots of other divisions and other railway.

RFID to be generated for all loco pilots of Mysuru and for all Locos of South Western Railway for all Locos of Hubli and Krishnarajapuram (Bengaluru) diesel shed.

Electronic devices may be installed and maintained at fuelling installation to generate loco wise and crew wise fuel consumption data.

Table 4.6: Select Issues for Management of HSD Oil

SN	Select Issues and their Description
1	***Reduction of HSD Oil – Controlling Supply Chain Management of HSD Oil***
	A model of RCD should be adopted by Railway in which the supplying company and will own the installation and maintain it. Inventory will also be under the oil company. The Company will supply HSD Oil to locomotives at fuelling point development. For this, modality should be developed with use of IT and Electronics. A MOU should be signed between Oil Company and Railways for effective fire fighting at RCD. Locomotive should be given HSD at a RCD where HSD oil prices are minimum. However need of trip ration and minimum fuel balance should be kept in view. Use of IT to pair fuel dispensing with fuel received in fuel tank of loco.
2	***Improving of SFC of Locomotive***
	Provision of Auxiliary power unit electronic injection system, common oil direct injection system, multi grade oil. Proliferation of hotel load locomotive and HHP locomotive.
3	***Reduction of fuel consumption on line***
	Loco link rationalization Crew link rationalization Up gradation of drivers training – drivers are to be trained for new locomotives. For this, training needs are to be assessed and facilities like loco simulator for new locomotives should be provided. Sequencing of the trains should be done so that there are minimum halts of trains on line. Provision of hotel load locomotives on end on generation trains. By this power car can be removed. Identifying and removal of temporary and permanent speed restrictions. Strengthening of fuel cell organization at Divisional as well as at headquarter level so that a close watch can be kept on trip ration and the performance of the drivers. Guidance for Optimized Loco Driving (GOLD)
4	***Other Measures***
	Use of alternative fuels like bio-diesel, LNG etc. Improvement in the design of rolling stock to make them more aerodynamic. Ensuring spillage-free environment through improved dispensing techniques

Source: outcome of workshop of experts held at National Academy of Indian Railways, Baroda, Vadodara in 2015.Data Compiled by researcher

4.8 Case II: Procurement of Electricity in the Indian Railways

Indian Railways is one of the very large consumers of power. As on March 2014 Indian Railways has network of about 65436 route km. for transportation of about 23 million passengers and 2.77 million tons freight daily. Indian Railways procure electricity through Distributor Companies across India for running more than 400 traction substation and about 5000 non traction service station. Traction substation supply electrical energy for running of the train at 222/232/132/110 KV/25 KV. Non-traction service station at 11/33 KV to 0.440 KV) for general supply to station, buildings, colony, hospitals etc. 38% of total track that is 24891 route kilometres is electrified. Which haul about 63% of freight traffic and 50% passenger. Indian Railways electricity bill is more than Rs.10,000 crores per year for traction application and around Rs.1650 crores per year for non-track application. During 2013-14 Indian Railways consumes 15.5 billion units for traction and 2.5 billion units for non-traction (total 18 million units) which is roughly 2% of power generation in India. The average cost of procurement of power per unit is Rs. 6.79 during 2014. The rate however varies from Rs.3.83 per unit charge by Damodar Valley Corporation (DVC) to Rs. 9.35 charged by Maharashtra State Electricity board. In the current system, procurement of electric energy by Indian Railways is in seller's market environment. Indian Railways procures electricity from Distributor Companies on the terms conditions and rates decided by Distributor Companies as monopoly supplier. There are several pockets of optimization. The objectives for improvement are rationalization and optimization of procurement of electrical energy, inventory Management i.e. to substation capacity optimization and the energy charges paid by Railways is indicated in Table4.7

Table 4.7: Electricity Supply Rates of Various Distributor Companies

Energy Charges (Traction) for 2014-15					
SN	**DISCOMs**	**Average cost Rs/Kwh.**	**SN**	**DISCOMs**	**Average cost Rs/Kwh.**
1	APTRANSCO	7.15	12	MPSEB	6.01
2	BSEB	6.25	13	MSEB	9.35
3	CSEB	5.59	14	TATA	7.80
4	DVB	7.97	15	NTPC	6.57
5	DVC	3.83	16	PSEB	6.30
6	GEB	6.39	17	RSEB	5.41
7	GRIDCO	6.14	18	TNEB	6.88
8	HVPN	7.09	19	UPPCL	7.37
9	JSEB	6.21	20	WBSEB	7.89
10	KSEB	5.41	21	UPCL	4.38
11	KPTCL	5.53	22	CESC	7.05
				Grand Total	**6.79**

Source: Report of the committee for Preparation of 'Energy Plan' for Indian Railway, Central Electricity Authority February 2015, pp. 48

4.8.1 Roadmap for Supply Chain optimization of Electrical Energy

Not much work has been done in the area of Supply Chain Management (SCM)of electrical energy however the concepts and research paper written on supply chain management of perishable commodities and scenarios of news vendor problem were found useful in giving directional thinking on the subject. A workshop of top level executives of Indian Railways was conducted at National Academy of Indian Railways (NAIR), from 06.07.2015 to 11.07.2015. A description of these is elaborated in Table 4.7.The insights derived from the workshop highlight the inefficiency in power management and high rate of purchase. The policy makers of Railway Board also participated in this workshop. The theme of this workshop was to optimize the supply chain of energy. The best practices in this area were discussed along with the policy issues. Some of the outcomes of this workshop are articulated in this research paper. Eight semi structured interview with top executive and policy makers of Indian Railways in this filed. A workshop of Senior Management group officers was conducted at National Academy of Indian Railways in July 2015 to flag the issues in SC of Electrical Energy. Select Issues for reduction in electricity bill is elaborated in Table 4.8.

Table 4.8: Key Insights derived during Workshop on Supply Chain of Electricity

SN	Key Issues and Suggestions Received during workshop from Indian Railways Officials
1	***Reduction of Electrical Energy bill – Controlling Supply Chain Management of Electrical Energy Generation, Transmission, Distribution and purchase***
	A model for electrical power energy purchasing directly from generating units across India through Central Transmission Units/ State Transmission Units after paying free wheel charges should be adopted by Railway to reduce energy unit cost by approx. 30%. The energy cost will further reduce if Indian Railway migrates from DISCOMs to GENCOMs. As per Supreme Court order, cross subsidy charges should not be more that 20% of cost of procurement by DISCOMs. It will reduce present unit costs in many states in India. Replacing conventional rakes by MEMU/DEMU where there is short stoppage like in Bihar. IR should work on a model to purchase electrical energy from generating units based on more than one state jurisdiction so that CERC should not come in to the picture for tariff calculation and only CERC to decide tariff. IR should also explore purchasing of power from exchange at competitive tariff rate so that the advantage of having very low tariff during night can be taken as IR is 24 X 7 working organization. Provision of Availability Based Tariff (ABT) meters with communication facilities along with CT&PT of 0.2S class at each TSS (Traction Sub Station) should be required for getting power from nearest CTU/STU transmission lines. Railways should explore installation of short distance transmission lines for connecting IR Traction Sub Station to CTUs/STUs transmission lines for traction purpose. Power from a given point can be taken through Power Purchase Agreement and consumed at any desired location by paying wheeling charges for the distribution network connecting the two points. Representations against cross-subsidy to be filed with Central/State Regulatory authorities for

SN	Key Issues and Suggestions Received during workshop from Indian Railways Officials
	waiver by Railways /PUs. Budget provision should be made for procurement of ABT meters. There is an ambiguity in the allocation for procurement of such meters: clarification required, whether chargeable to Abstract E or H? Study of geographical distances to be covered across Railways to carry out assessment of transmission network requirement for connecting directly to GENCO through Rly's own transmission network.
2	***Reduction of electrical energy consumption on line***
	Conventional locos should be replaced by regenerative breaking 3-phase locos. Loco link rationalization Crew link rationalization Up gradation of drivers training – During simulator training, loco pilots should also be graded for energy efficient driving technique and marking for this should also be in corporate. Driving techniques for passenger loco pilots should be monitored and analyzed for a given section to improve driving techniques to reduce loco energy consumption. Right powering of locos. Locos utilization should be improved and locos should not be idle.
3	***Use of environment friendly non-conventional source of energy like Solar Power and Wind Power***
	Capital cost of solar power generating unit is high. Solar photo voltaic cell without battery should be used which is in long run is cost effective. On experimental basis, solar panels are provided in a coach. In the new coach if the roof top surface is replaced by solar thin film panels or solar panel than per coach tear weight will be reduced compared to this experimental train. Wind power plant should be used where wind speed is relatively high and using national grid power can be used anywhere in Railway. Roof top solar power should be provided for offices.
4	***Other Measures***
	LED lights should be used in offices, stations, coaches etc. Occupancy sensors should be used in offices for automatic switching OFF light, fan and AC. Pre-paid energy meters in residential colonies should be used to reduce power theft. Timers in street light. Internal energy auditors should be used for energy auditing by giving them some incentives.

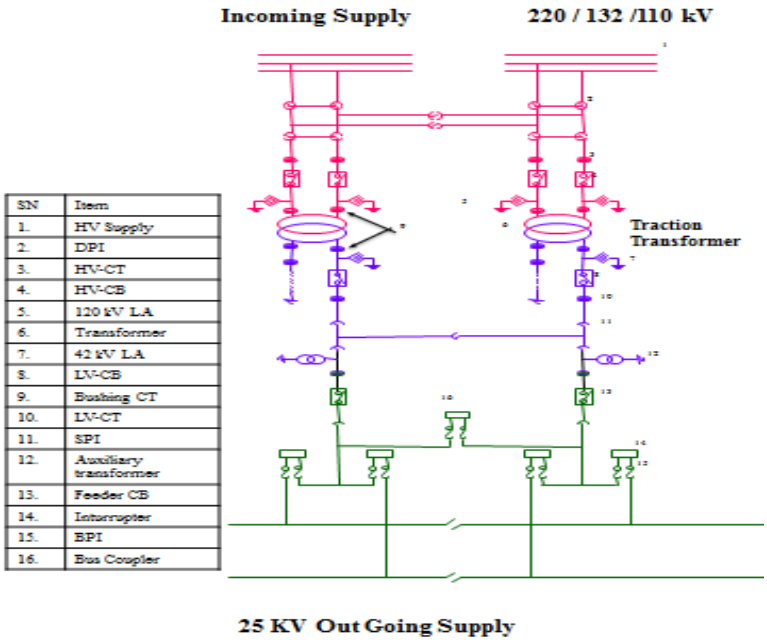
Source: outcome of the workshop of experts held at National Academy of Indian Railways, Baroda in 2015. Data Compiled by researcher, sources used are given below.

12th Five year plan document issued by planning commission about the current status and future scenario of power sector in India. Electricity Act 2003, Gazette Notification No.36 (2003) issued by Ministry of Law and Justice. This act is about the change in regulatory regime to bring in growth, competition and transparency in the power sector. Indian Railway annual budget for year 2013-14- Report of the committee for preparation of energy plan for Indian Railways made by Central Electricity Authority (CEA) February 2015.Indian Railway Policy Circulars.

4.8.2 Mapping of Current Electric Supply Chain of Indian Railways

Indian Railway procures the electrical energy from different distributor companies across India on monopoly single supplier basis at the rates terms and conditions prescribed by

distributor companies. These distributor companies are having the arrangement of procurement of electrical energy from power Generating Companies (GENCOM). Transaction between distributor companies to Indian Railway is like a seller's market situation. So much so that within jurisdiction of one executive officer there could be different distributor companies supplying the electricity at different rate to different traction substation within close vicinity. Schematic diagram of supply of electrical energy is given as Figure 4.6.The traction substation gets the electrical energy from Distributor Companies. There are around 400 service station of Indian Railway of various capacities. There is long term agreement with Distributor Companies. Billing is raised on the basis of energy consumed and contract demand. Railway is required to pay the fix charges for the contract demand. If the drawl of energy exceeds the maximum contract demand for 15 minutes the entire month is charge at a rate which is much higher than the contract demand rate. For example Madhya Gujarat Bijli Company Ltd. Charges @Rs.180 per KVA per month up to the contract demand.



SN	Item
1.	HV Supply
2.	DPI
3.	HV-CT
4.	HV-CB
5.	120 kV LA
6.	Transformer
7.	42 kV LA
8.	LV-CB
9.	Bushing CT
10.	LV-CT
11.	SPI
12.	Auxiliary transformer
13.	Feeder CB
14.	Interrupter
15.	BPI
16.	Bus Coupler

Figure 4.6: Schematic diagram of AC traction on Indian Railways
(Source Indian Railway AC Traction manual Volume-II Part-I)

If billing demand is an excess of contract demand even for 15 minutes in a month the charges are Rs.425 per KVA per month. It is clear that there is a heavy penalty even if demands exceed the maximum contract demand of a substation for 15 minutes. This has got a classic

'Bullwhip effect' and there is always tendency to enhance the capacity so as to avoid penalty. Moreover there is a strict monitory of penalty and not so strict monitoring of underutilization of traction substation capacity. The summary of traction service station as on 01.04.14 and average monthly consumption is given in table4.9

Table 4.9: Details of Traction Substation as on 1.4.2014

SN	Railway	Service stations	Contracted Max. demand	Average recorded Max. demand during 2013-14 (MVA)	Average monthly energy consumption	Load Factor % =(6)/(3x24x30/1000)
	1	2	3	4	5	6
1	CR	43	430	442	26	0.08
2	ER	19	246	231	74	0.42
3	ECR	27	346	310	85	0.34
4	ECOR	35	384	405	85	0.31
5	NR	29	268	221	51	0.26
6	NER	1	10	2	0.11	0.02
7	NCR	40	385	308	85	0.31
8	SR	34	354	330	85	0.33
9	SCR	39	530	483	130	0.34
10	SER	33	544	441	133	0.34
11	SECR	22	358	334	90	0.35
12	SWR	3	40	19	5	0.17
13	WR	31	442	406	125	0.39
14	WCR	25	340	368	98	0.40
15	METRO/ KOLKATA	4	33	30	8	0.34
	Total	**385**	**4710**	**4330**	**1080.11**	**0.32**

Source: Report of the committee for Preparation of 'Energy Plan' for Indian Railway, Central Electricity Authority February 2015 pp.48

It can be seen that from total contracted maximum demand of 4710MVA the average monthly energy consumption is only 1080 MUs. That means a average load factor of less than 35 per cent. This is equivalent to keeping the inventory of three times the average consumption.

4.8.3 Findings and Discussion

The energy cost constitutes 29 per cent of ordinary working expenses of Railways out of which 10 per cent is electricity and 19 per cent is expenditure on diesel. Electrical traction hauls around 67 per cent of freight and 50 per cent of passenger traffic. Shift of traction from diesel to electric is generally a priority area on account of economy and environmental

friendliness. The increasing cost of electrical energy is however the area of concern as can be seen in Figure4.5

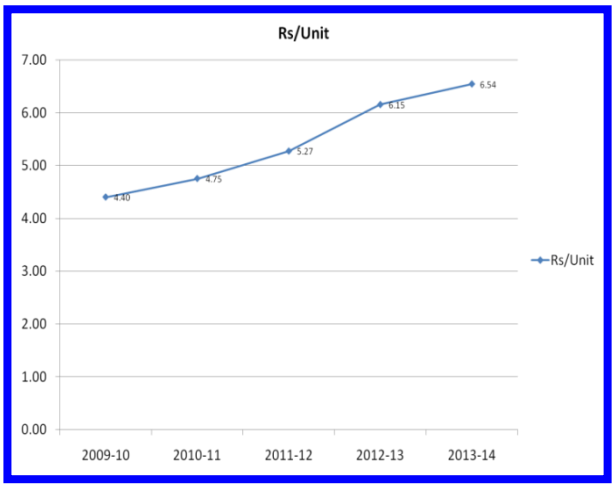


Figure 4.7: Cost of Electrical Energy (Source Indian Railway)
Source: Report of the committee for Preparation of 'Energy Plan' for Indian Railway, Central Electricity Authority February 2015 pp.48

The Para 106 of honourable Railway Minister Budget Speech 2015 gives due importance to the area of optimization of expenditure on electrical energy. Although a bulk consumer, Railways pays extremely high charges for traction power. It is proposed to procure power through the bidding process at economical tariff from generating companies, power exchanges, and bilateral arrangements. This initiative is likely to result in substantial savings of at least Rs. 3,000 Crores in next few years. Rationalization and optimization is possible both as a short term and long term measures.

4.8.4 Optimization of Contract Demand at Traction Substation

The data of demand pattern of traction substation from 17-08-15 to 23-08-15 for every 15 minutes interval at four adjoining traction sub-station Igatpuri Station (IGP), Kasara Station(KSRA), Titavala Station (TLA), Tambadmal (TMM) of Mumbai division of Central Railway was collected. There were 669 records for each traction substation. Total power drawn at all the four substations on time series data was also computed. It was presumed that the power drawn from a substation wills follow a normal curve. In order to check this normality and reliability (using Cronbach's Alpha) of the data was assessed through SPSS software. Figure 4.8 depicts normal distribution pattern of the data.

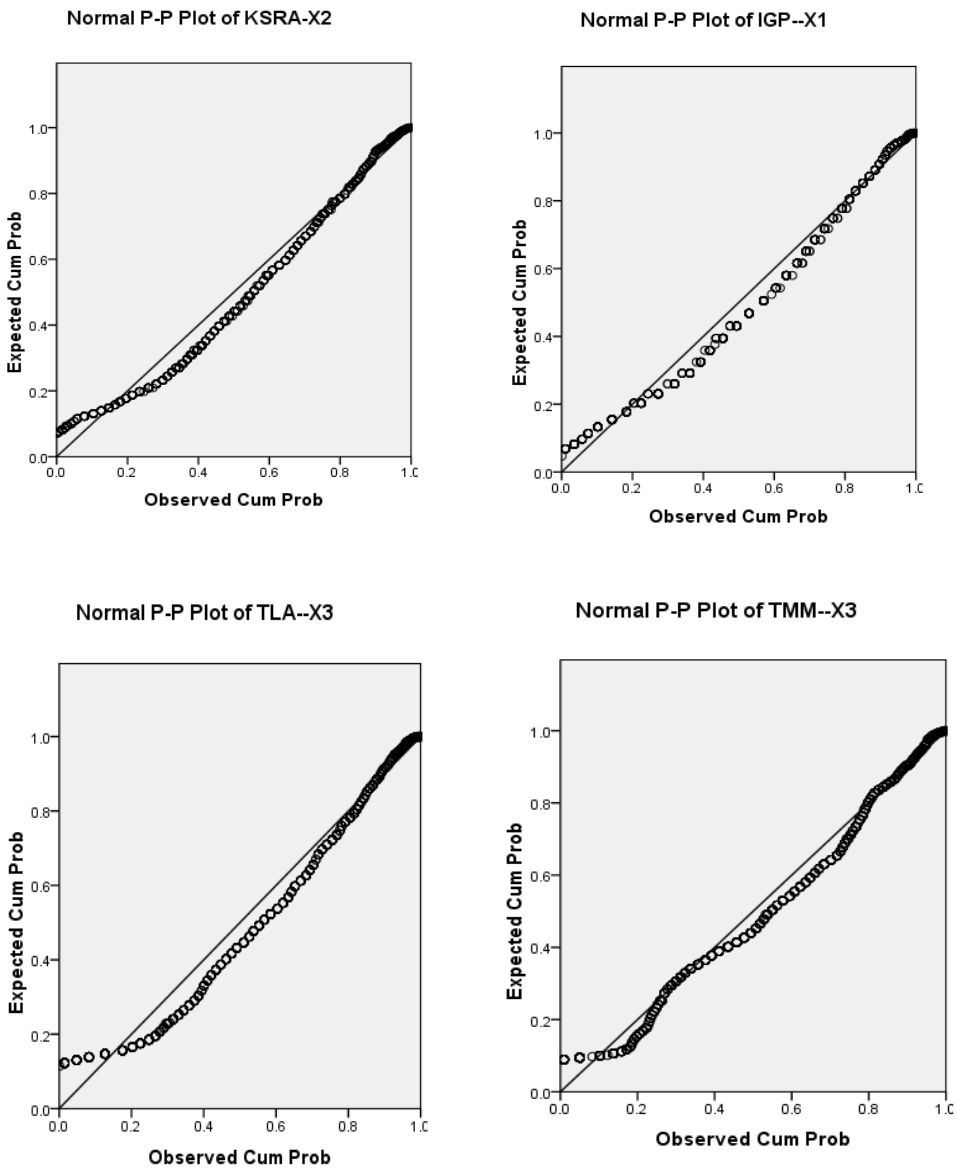


Figure 4.8: Result of Normality Test of Data for Various Substations

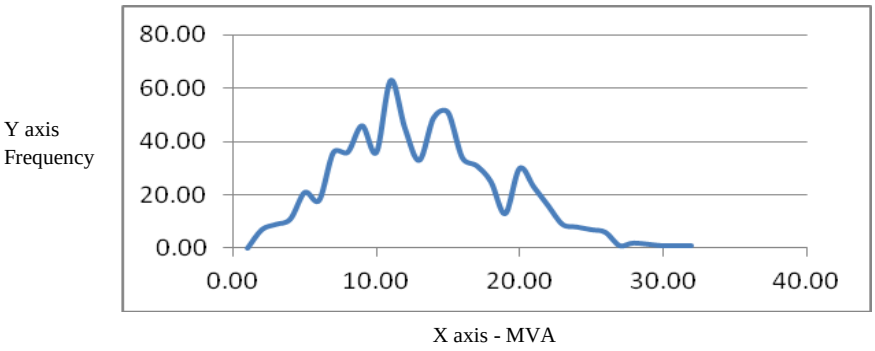


Figure 4.9 Normality Assessments for Aggregated Data.

Current drawn from a substation depends on the number of train set drawing current from that station. Occurrence of train in substation is random and it was presumed that it follows normal distribution.

Substation capacity is estimated on the basis of peak load. The capacity can be defined as contract demand. The contract demand is measured in Mega Volt Ampere. If the current drawn is within the contract demand, rate changed is as per the contract agreement, but in case for some unforeseen circumstances like bunching of trains if current drawn exceed the contract demand for more than 15 minutes in a month, the entire month is charged with a heavy penalty. Government organizations due to accountability principle are averse to payment of penalty therefore there is tendency to play over safe and go for higher capacity at station.

If more than 2 substations are clubbed the load pattern becomes smoother. It is observed that peak demand of requirement of substation is much lower than the requirement of individual plot of each substation. The above hypothesis is demonstrated by collecting the data at 4 substations of Mumbai. It follows the normal distribution as per statistical summary given below.

$\mu + 2\sigma$ shall give 97.7% and $\mu + 3\sigma$ shall give 99.86% compliance. From this it can be seen that contract demand can be planned for $\mu + 3\sigma$, it shall give us 99.86% compliance below the contract demand. Where it is seen that the contract demand of individual traction substation is much higher and total contract demand is also higher. The maximum drawl from individual traction substation has been higher then $\mu + 3\sigma$ in some isolated cases which has caused higher contract demand but the maximum drawl at all the four substation put together has been 36.49 KVA which is 42% lower as compared to sum of individual contract demand (= 60KVA).

Making Super Traction Substation Like Super Store

There is excess capacity build up at each service station to meet the peak demand. The train load is moving as such if three or more substations are clubbed then the peak demand of one traction substation will be balanced by lean demand of other. Sum of the contract demand of individual substation will always be much higher than the combined peak demand of the 3 or more traction substation. This is like having a central warehouse instead of several decentralized warehouse to meet the individual peak demand. It is seen that in Allahabad division of North Central Railways (NCR) 16 traction substation are clubbed with contracted

maximum demand of 100MVA and average monthly consumption of 67.11 million units which is 95% of the load factor. Table 4.10 whereas on all India basis the load factor is less than 35 per cent

Table 4.10: Statistical Summary for Contract of Power Drawn At Various Locations in Central Railway, Mumbai Suburban Substations

Traction substation	**IGP(KVA)**	**KSRA(KVA)**	**TLA(KVA)**	**TMM(KVA)**	**Total(KVA)**
Contract Demand	10	15	15	20	**60**
SD σ	1.08	2.60	2.67	3.15	**5.53**
Mean μ	1.82	4.34	3.20	4.34	**13.70**
Max	6.10	15.15	13.82	19.92	**36.49**
Min	0.00	0.51	0.00	0.10	**2.34**
μ + 2σ	3.98	9.54	8.54	10.64	**25**
μ + 3σ	5.07	12.14	11.20	13.79	**30**

IGP, KSRA, TLA, TMM, KVA are names of various locations
Based on Data collected from Central Railway Mumbai Division (2015)

The clubbing of traction service station fed by same distributor companies can be easily done by renegotiating with distributor companies.

Clubbing of Three or More Substation

Optimizing the total substation capacity following the normal distributes pattern and dynamically controlling the demand within maximum contract demand. In any case Railways work on more than 100% redundancy i.e., In case of traction substation facture, system exist to draw power from neighbouring sub-station. By clubbing of traction substation load factor shall improve substantially. On Indian Railways at Allahabad Division 18 traction substation are clubbed giving load factor of 95%, whereas overall Indian Railways average 32%. It is possible to improve the load factor to 60% which implies that maximum contract demand should be

Load factor= Actual energy consumption /maximum energy consumption

Maximum possible energy consumption = 1080.11/0.6 MU

Maximum MVA required = 1080.11x1000/ (0.6x24x30)

= 2500MVA

Saving in contract demand is 4710-2500 = 2210

Saving (in Rs.) = 2210x1000x180 (Rs. 40 Crores per year)

The Cross Subsidy Charges

State electricity regulatory commission allows the recovery of cross subsidy charges up to max 20% from the individual industrial user by the distributor companies to subsidize the cheap power supply to farmers. Maharashtra Electricity Board, Tata Powers, Uttar Pradesh Power Corporation Ltd (UPPCL), West Bengal State Electricity Distribution Company Limited (WBSEB) and Calcutta Electric Supply Corporation (CESC) are charging higher cross subsidy charges. Moreover provision content in 38, 39 & 42 of electricity act do not provide for levy of cross subsidy charges on deemed licensee. Indian Railways has been granted the status of deemed licensee under the electricity act 2003, third proviso to section 14 of the electricity act 2003. Railways administration can take up the matter with State/entity for avoiding the cross subsidy charges.

4.8.5 Direct Power Procurement by the Indian Railways

Currently Indian Railways is procuring power from distributor companies at tariff which is comparable to industrial rates. Ministry of Power vides their letter No.25/19/2004-R&R dated 06.05.2014 clarifies that Indian Railways is a "Deemed Licensee" under the provision of electricity act 2003. So the Indian Railways can procure power directly from any generating company after obtaining open excess of transmission of power thorough central or state transmission network. Indian Railways can work on a model to purchase electrical energy from generating units based on more than 1 state jurisdiction so that only Central Electricity Regulatory Commission (CERC) decides tariff. The higher cost of procurement is mainly on account of cross subsidy charges levied by the state to industrial consumer. Average cost of energy by Indian Railways is Rs. 6.79 per kWh, ranging from Rs. 3.83 per kWh in DVC to Rs. 9.35 per kWh in Maharashtra.

4.8.6 Roadmap for Cost Optimization

Electricity act 2003 section 38, 39 and 42 have a provision of non-discriminatory open access to transmission system by Central Transmission Utility (CTU) for use by any licensee or generating company on payment of transmission charges.

Average cost of generation of power is Rs. 3.7 per unit from generating company plus there will be additional Rs.1 per unit charge for wheeling and Central Transmission Utility / State Transmission Utility (CTU/STU) charge. Total cost will be little less than Rs. 5 per unit as against Indian Railways average of Rs. 6.79 per unit. The electric substation where the cost

of procurement is more than Rs.5 per kWh and are connected to state or central transmission network can be migrated to the system of direct procurement by Indian Railways from Generator Companies. This will involve installation of suitable Availability Based Tariff (ABT) meters with communication facilities at each track substation. This will require forecasting and scheduling of demand and tie up of back up supply arrangements in case of outage. As per methodology of scheduling specified in the Indian Electricity Grid Code (IEGC) - Scheduled is prepared one day ahead divided into 96 time blocks of 15 minute search. Indian Railways is having strong and reliable data of past consumption. The demand pattern follows normal distribution curve. Forecasting can be made at $\mu + 2\sigma$ for 97.5 or $\mu + 3\sigma$ for 99.85% compliance.

Backup Arrangements

Till the system get stabilized and smoothen Indian Railways will have to make alternate supply arrangements by way of separate agreement with concerned distributor companies for which separate charges will have to be pay. Indian Railways can also install their own 220KV network on trunk routs Short distance transmission line for connecting traction substation to Central Transmission Utility / State Transmission Utility (CTUs/STU) transmission line. Considering the potential in saving of cost this will be an attractive investment proposition. Indian Railways is setting up a coal based power plant in Nabinagar in Bihar in joint venture with National Thermal Power Corporation. The total capacity of power plant is 1000 MW. Share of Railways is 900 MW. Some more joint venture efforts are made for procuring power from Gujarat Urja Vidhyut Nigam Ltd. As per section 38D of electricity act the cross subsidy surcharge shall not be chargeable to an individual user who has established captive generating plant for electricity of his own use.

4.8.7 Procuring Electricity through Power Exchange

At lower tariff a pilot project is initiated in Haryana. The power is available through power exchange at a very cheap cost during lean night hours. Indian Railways requirement during lean time can be procured through the power exchange to further reducing the energy bill. The functioning of power exchange is shown in Figure 4.7

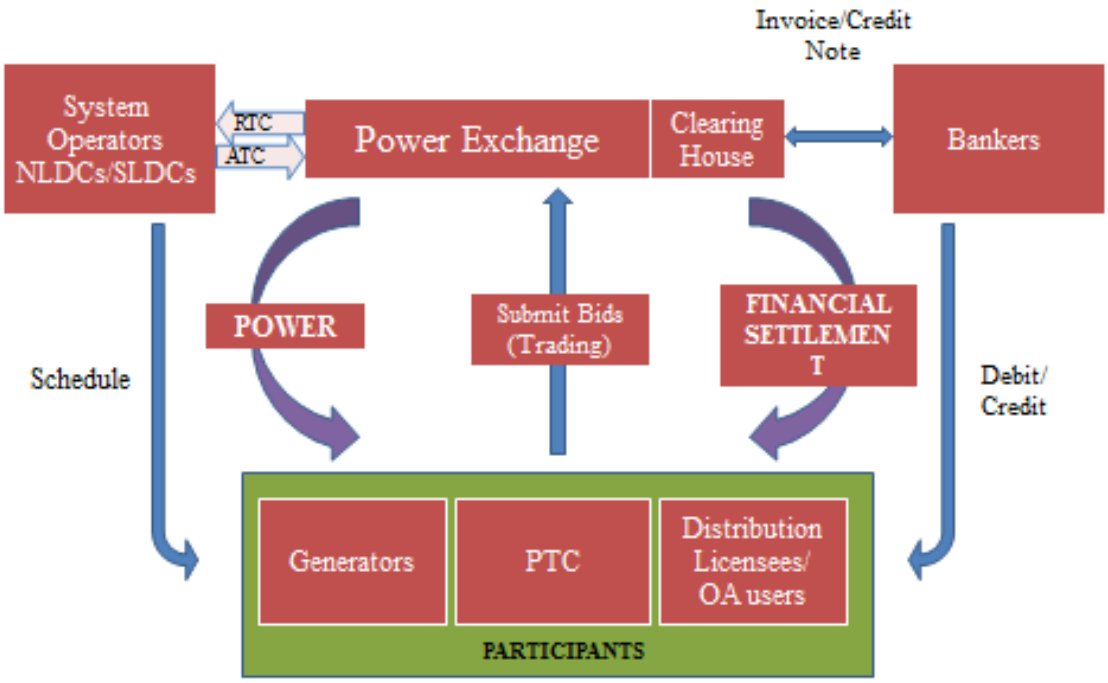


Figure 4.10: Functioning of a Typical Power Exchange (Adapted as per Power Trading Corporation, Subsidiary of National Thermal Power Corporation of India)

4.8.8 Energy Conversion Measures

Energy saving potential of Railways is estimated to be about 10-20 per cent. Various measures are under taken to promote energy efficiency in non-traction establishment.

Petroleum Conservation Research Association (PCRA) has carried out energy audit in various Railways colonies. Energy saving potential of 22 million units per year is projected (Report of CPEP for the Indian Railways February 2015 pg. 28-29) (Internal Document of the Indian Railways). The various measures such as adoption of LED lighting, construction of building on Green building concepts, use of super efficiencies ceiling fan etc. are be under taken regularly. Indian Railways is defined as a designated consumer under the Energy Conservation Act 2001; as such they are required to undertake mandatory energy audit to accredited energy auditors. Railways on its own shall propose base line methodology and fixations energy performance indicator to ministry of power. Indian Railways is a large consumer of energy it uses 18 billion of electricity per year which is around 2 per cent of electricity generated in the country. Electricity is drawn from DISCOM spread across the

country. The conversion of diesel traction to electric traction is one of the priority areas which is economical as well as environmental clean. The expenditure and rising cost of electricity is the priority area of optimization and enough potential exist in this area. Various measures proposed in the paper can bring out substantial reduction in energy bill. Researcher feels that saving of Rs. 3000 Crores in next few years announced by Minister of Railways is an achievable target.

4.9Summary

The Chapter deals with commonality and difference between public and private procurement. It describes the theoretical framework of procurement on Indian Railways and evaluates its pros and cons. It also compares the key performance indicator of a typical automobile industry and Indian Railways. Finally the chapter also deals with case studies of procurement of high speed diesel and electrical energy on the Indian Railways

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