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

Atul Gupta¹, Dr. Gyan Prakash², Dr. JayrajSinh Jadeja³

¹National Academy of Indian Railway Vadodara
²ABV-Indian Institute of Information Technology & Management Gwalior, India
³Faculty of Management Studies, M.S.University of Vadodara

Abstract

Purpose- This paper provides analysis of supply chain management framework in the public procurement environment through a case study of the Indian railway. The paper provides some insights about the evolution of supplier relationship management and its impact on key performance indicators. Its also provides an integrative framework for management of public procurement.

Methodology- The paper builds on extensive review of literature and follows a case study methodology. The unit of analysis is the Indian Railway’s material management function. Analysis uses data of over a period of five years.

Finding- The finding highlights that supplier relationships with the Indian railway have been geared around arms-length philosophy. The current symptoms of inefficiencies are reflected in high cycle time, high costs associated with supplier selection process, poor accountability, blurring of responsibility and poor value creation for all the stakeholders. The current procurement mechanisms are not crafted around development of long term strategic partnerships.

Research limitations/implication- This study is filling the gaps in literature by presenting the challenges of supply chain management in the public procurement environment. Insights from developing country like India can be applied to other public procurement systems.

Practical Implication- The paper deals with sensitive issue of public procurement system. The findings would be useful for policy makers in developing mechanisms for instilling insights of business management into the realms of public management.

Originality/value- The study is first of a kind to provide a conceptual framework for understanding building blocks of the supply chain management in the public procurement environment.

Key word- Supply Chain Management (SCM), Public Procurement (PP), Key Performance Indicator(KPI), Indian Railway (IR), Material Management (MM), Performance Management System (PMS), Third party logistics (3PL), Bill of Material (BOM), Leading Automobile Co. (LAC), Long term contract (LTC)
1. Introduction

Indian Railways is Govt. of India organization under Ministry of Railway. It is third largest Railway network in the world. It is referred as life line of Indian economy and facilitate economic and social development by connecting small village and urban centres. It is a tool of development equity and integration of all parts of India to main stream. It plays very crucial role by providing affordable transportation service to passenger and freight. It is also important from perspectives of defense movement and meeting the transportation requirement in wake of emergency and natural disasters.

Importance of Railway in Indian Transport network: Presently it operations 19000 trains a day transports 2.9 million tones of fright traffic and 23 million passenger per day. It is world largest passenger carrier and fourth largest freight carrier. During year 2012-13 the freight loading was more than 1 billion tone and passenger transported stood at 8.4 billion. IR provide direct employment to 1.3 million people and much larger indirect employment. The idea about size and operation of Indian Railways can be gained from following table.-

Table-1 General Statistics of IR

<table>
<thead>
<tr>
<th>SN</th>
<th>Item</th>
<th>Unit</th>
<th>2011-12</th>
<th>2012-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Route length</td>
<td>kms.</td>
<td>64,600</td>
<td>65,436</td>
</tr>
<tr>
<td></td>
<td>Locomotive</td>
<td>Nos</td>
<td>9,549</td>
<td>9,956</td>
</tr>
<tr>
<td></td>
<td>Passenger Service Vehicles</td>
<td>&quot;</td>
<td>55,347</td>
<td>57,256</td>
</tr>
<tr>
<td></td>
<td>Wagons</td>
<td>&quot;</td>
<td>2,39,316</td>
<td>2,44,731</td>
</tr>
<tr>
<td></td>
<td>Railway Stations</td>
<td>&quot;</td>
<td>7,146</td>
<td>7,172</td>
</tr>
<tr>
<td>2.</td>
<td>Operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Passenger origination</td>
<td>Millions</td>
<td>8224</td>
<td>8421</td>
</tr>
<tr>
<td></td>
<td>Passenger kilometers</td>
<td>Millions</td>
<td>1046522</td>
<td>1098103</td>
</tr>
<tr>
<td></td>
<td>Freight Traffic (Revenue)</td>
<td>Millions</td>
<td>969.05</td>
<td>1008.09</td>
</tr>
<tr>
<td>3.</td>
<td>Volume of Traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Passenger kms</td>
<td>Millions</td>
<td>10,46,522</td>
<td>1,098,103</td>
</tr>
<tr>
<td></td>
<td>Total traffic (incl.non-revenue)</td>
<td>Millions</td>
<td>975.16</td>
<td>1,014.15</td>
</tr>
<tr>
<td></td>
<td>Freight traffic (Revenue)</td>
<td>Millions</td>
<td>969.05</td>
<td>1008.09</td>
</tr>
<tr>
<td>4.</td>
<td>Employment and Wages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular employees</td>
<td>Thousands</td>
<td>1,306</td>
<td>1,307</td>
</tr>
<tr>
<td>5.</td>
<td>Financial Results</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Revenues</td>
<td>In core Rs.</td>
<td>1,04,110.36</td>
<td>1,23,732.59</td>
</tr>
<tr>
<td></td>
<td>Expenses</td>
<td>&quot;</td>
<td>98,667.41</td>
<td>1,11,572.04</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous transactions</td>
<td>&quot;</td>
<td>1,338.66</td>
<td>1,454.64</td>
</tr>
<tr>
<td></td>
<td>Net revenue (before dividend)</td>
<td>&quot;</td>
<td>6781.61</td>
<td>13,615.19</td>
</tr>
</tbody>
</table>

(source- Indian Railway year book 2012-13)
Railway is a preferred mode of transport due to its-
1) Cost effectiveness
2) Safety and security
3) Environment friendly
4) Land requirement per unit of transport

Considering these natural advantages the ideal share of railway should be 80% but over the year share of railway traffic is falling and at present it stood at 30% in favour of railways, 61%. Roadways and 9% others such as pipeline, waterways and airways etc.

Fig.1

Mode Share in Freight Traffic

(Source:- Material Transport Development policy committee June2012)

2. **Role of procurement in organization**-
   - Any organization public or private require external resources in peruse of its objectives. Such resources could be Goods, services, works or consultancy. It could be tangible or intangible.
   - Procurement is important strategic business management function to manage entire process from assessment of need, identification of product, forecasting, sourcing, logistics, risks managements, value engineering, supplier relation management and regulatory compliance efficiently and effectively. The function is answerable to objective of organization and expectation of stakes holders which include share holders, employee, customer, society at large, government and environment. Procurement is the science and art of supply management managed by competent, knowledgeable, practitioner and professional.
   - The procurement function is having the strategic importance as 60-70% of expenditure of an organization is incurred in procurement. It helps organization to improve profitability, market share, reducing time from concept to market, improving customer satisfaction, help in R&D for better quality, better values, technological improvement, innovation, help in delivering better product and service and mass customization etc.
2.2 **Public Procurement**: Public procurement as defined in Public Procurement bill placed before Indian Parliament is:

“Procurement or Public Procurement means acquisitions by purchase, lease, license or otherwise of goods or service or any combination thereof including award of Public Private Partnership project by procurement agency directly or through an agency for which contract for procurement is entered into”

- Public procurement refers to procurement by Govt. agencies these may be central government, state govt., PSUs, procurement through multilateral funding or any entity where more than 50% equity is held by Govt. including procurement under Public Private Partnership projects i.e. PPP.

- The objective of Public Procurement as defined in Public procurement bill placed before Indian Parliament is: “Ensuring transparency accountability, and probity in the procurement process, fair and equitable treatment to bidders, promoting competition, enhancing efficiency and economy, maintaining integrity and public confidence in the Public Procurement Process”.

- Public procurement generally account for large share of Govt expenditure in domestic economy. It is having strategic importance from point of view of huge amount of expenditure and the purpose for expenditures which is generally social, health infrastructure etc. to give boost to the economy. The Public Procurement expenditure in India per annum is estimated to be more than US $ 300 billion, approx Rs. 1.5 lakh crore i.e 25 to 30% of the GDP. A mere saving of 10% by way of economy and efficiency in operations would released Rs. 1.5 lakh crore. The entire resource realized can be utilized for building social and infrastructure sector of economy. Moreover if public money in efficiently spent in any project there are better chance of its success of achieving the laid down objectives. This can lead to effective development of country in particular the poorer section.

- The public procurement is done to achieve policy outcome of Govt.- i.e. a safe tolerant society, well educated citizen and so on. Govt. develop 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 sector of industry, economy and society, environment and infrastructure.

2.3 **The common in Public and Private Procurement**: The basic aim of Public or Private Procurement can be described in 6R –

1. Right quantity
2. Right quality
3. Right price i.e. Value for money (VFM), Life cycle cost (LCC), Total Cost of ownership (TCO) concept
4. Right source
5. Right time and place
6. Right and ethical method
2.4 Deference in Public and Private Procurement-
1. Transparency - Fairness, equality, competitions, appeal rights
2. Professionalism - economy, efficiency, effectiveness and integrity
3. Responsiveness - to different stake holders, citizen, tax payers, society,
4. Constitute principal - Article 14 equality and 19 freedom of expression, Article 299, RTI
5. Multiplicity - Many goals at the same time beside organizational goal often conflicting with each other.
6. Public Accountability - To parliament, Central Vigilance Commission (CVC), Central Bureau of Investigation (CBI), Comptroller and Auditor General of India (CAGI) etc.
7. Transitional concepts - Each transition is individually evaluated independently rather than judging the entire procurement process over a period.

3. Public Procurement on Indian Railways:-
Material Management deptt on Indian Railway ensures uninterrupted supply of material and stores. It has 262 warehouses and over 1 lakh material component stocked.

During 2012-13 total expenditure on Material was Rs. 36027 crores. Material Management deptt employs 26,660 no. of employee to manage its function.

Table-2 A broad analysis of purchase made by IR

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

(source- Indian Railway year book 2012-13)

3.2 Theoretical frame work of procurement-
- The items are given item code on the basis of Main Equipment/Assembly and Subassembly wise e.g. Diesel loco spare will have item code starting from 10 to 19, Electric loco spare will have item code starting from 20 to 29
- Purchase sub groups are organized on the basis of user group e.g. separate purchase group for procurement of Diesel Loco Spares, Electrical Loco Spares etc.
- There is a system of annual procurement of different items by inviting tenders for lump sum quantity required for years. Decision in high value tenders are taken by tender evaluation committee which consist of officers from users, Material Management and finance deptt.
- Most of the items (90-95%) in value terms are procured through approved sources. Approval of sources is done by centralized agency such as Research Design and Standard Organization (RDSO); Diesel Locomotive Works (DLW) or Chittaranjan Loco Works (CLW) etc. While approving the sources the engineering cost estimation of items is not the consideration.
2. Suppliers are required to arrange inspection of all consignments from 3rd party inspecting agency like RITES and RDSO prior to dispatch of Material.
3. Sources approving agency, procuring agency and inspecting agency are independent to each other.
4. Material is finally received and accepted by consignee who is warehouse incharge and then stocked and issued as per requirement.
5. Suppliers are required to submit bill, in prescribed format along with necessary document, such as Inspection certificate, dispatch details etc. for claiming payment.

**Fig-2 Flow chart of Procurement**

<table>
<thead>
<tr>
<th>Estimation of need</th>
<th>Consolidation of requirement and Approval</th>
<th>Issue of Tender Notification</th>
<th>Submission of Bid by Vendors</th>
<th>Bid evaluation and contract</th>
<th>Contract Execution</th>
<th>Receipt acceptance and storage by consignee</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **Evolution of Supply Chain Function:-**

- 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 (CSK). His main focus was availability of material, warehousing and logistic. Excess inventory was not much concern as compared to stock out were penalty was heavy.

  In 1970-80 with the rise of competition the business realized the importance of MM function as a powerful tool for enhancing competitive advantage and profitability. The designation changes to Material Manager. The focus area was reducing cost of material and cost on material, value engineering and vendor development besides availability and Inventory Management.

- Another quantum jump in role of MM function took place in 1990s when function of inbound logistic and out-bound logistic were clubbed to take advantage of synergy due to commonality of resources and skill.

- Now this function has evolved to Supply Chain management function and taken the shape of full operation in itself. It encompass all discipline and it is mother of all discipline. Industry do not compete their supply chain compete with each other. Often customer decision of purchasing a product is driven by supply chain of service provider.
In the spectrum of CSK to SC manager role of Material Manager in IR is between CSK and MM. Value Engineering and vendor development are done by RDSO dominated by user departments and contribution of Material Manager in these activities is insignificant.

For the purpose of comparison- the theoretical frame work of supply chain function in an automatic industry is represented in the flow chart fig-3

Fig-3 Theoretical frame work of inbound SC Function of a leading Automobile Co.(LAC)

5. Evaluation of Supply Chain Function:-

Performance Measures (PM) can be defined as the process of Quantifying efficiency and effectiveness of an action (Gunasekharan & Cobee 2007). Performance Measurement System (PMS) provide the necessary information for decision making and action. It plays important role in setting strategic objective evaluating performance and determining future course of action (Gunasekharan 2004). The main reason for poor performance of supply chain is lack of measurement system(Morphy 1999). The real challenge is therefore to develop suitable PMS, so as to improve organization performance and competitiveness.

To understand and evaluate the performance of inbound centric supply chain of IR. The KPIs of IR are summarized as below-
### Comparision of KPIs of IR with leading automobile co. (LAC)

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

For comparison the supply chain of LAC was studied- The cycle time of entering into the contract is approximately 6 months but this contract is on long term basis. Fortnightly delivery requirement with 2 hourly delivery scheduled is given as shown in figure-3. Average inventory is 2 hrs, stock out situation are very very rare and the procuremnt managers of LAC are given a target of reduction in bill of material (BOM) by 7% on year to year basis. This reduction in BOM is possible by amortising the fixed cost on life cycle basis and joint value engineering efforts by buyer and supplier. Total no. of active vendors are 290 only.

#### 5.2 The business process of inbound centric supply chain of IR is analyzed as under-

- **Codification of items-** Ideally an item should not have two item codes and two item can not have one item code. On IR the system of assigning item code is related to the end use. In case of commonality of spares in different type of equipment there is every possibility that the condition of unique item code of each item gets violated. Continuous efforts are done for unification of item code with limited success.

  Further the classification of item code as per industry category is better from procurement point of view.

- **Purchase sub groups are divided based on the end use of items.** Which result in to purchase of same category of item by different sub groups for example nylon bushes required for Diesel loco will be procured by different sub groups and nylon bushes required for electric loco will be procured by other sub group. Classification on the basis of industry category is better from procurement point of view.
Procurement is done for each item individually and independently on lump sum basis for each year. This results into long cycle time and duplication of efforts of finalizing the contract every year.

System of lumpsum procurement of all items on year to year basis has following demerits-
- 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 etc.
- Arms length supplier relation management.
- Poor incentive for innovation and value engineering.

Vender approval by centralized agency- RDSO/DLW/CLW
Vendor approved is a continuous process. Technical and financial competence of supplier is considered while granting approval but engineering cost estimation of the product is not discussed/negotiated. This many time leads to situation of cartel formation.

Quality assurance of incoming raw material primarily depends on pre-dispatch inspection in 100% cases. This result in higher inventory in the system, higher cycle time, poor responsiveness and if is a cost addition activity. Concept of developing process capability and six sigma are not yet used.

Logistics such as dispatches from vendor to warehouse and warehouse to consumer are arranged on piece meal basis. It can be arranged on 3PL basis. This will help in reduction of inventory. Real time tracking and optimization of transport resource. If we consider 5% as transport component out of total purchases, then total transport resource requirement is over Rs.1800 crs. p.a.

Procurement success depends on 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 interaction of procurement with other unit better the overall application of procurement lever” Rupert A Brandmeier and Florian Rupp 2010

The integration and cross functional interaction is some what missing.

6. Supplier Relation Management in Public Procurement:-
In public procurement environment including IR the supplier relation is strictly governed by specification of supply, terms and condition of the contract. There is poor incentive on the part of supplier to improve the product design and value engineering. Therefore supplier contribution in continuous R&D and value engineering effort is very much limited. More over 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 lumpsum procurement through competitive bidding is that a bidders will offer the minimum possible quality which is meeting the specification.

Supplier participation is the key for saving in BOM. There are other advantage in long term contract such as lower cost, responsiveness of supplier, and lower inventory etc.
• Generally it is a myth that long term contract does not fall within the frame work of public procurement environment. Public procurement regulation issued by UNCITRAL chapter 5 permits frame work agreement as acceptable mode of procurement. Public procurement bill placed before Indian Parliaments also allow frame work agreement as acceptable mode of procurement. In the frame work agreement contract the price revision after finalization of contract can be done in accordance to frame work without further competition.

• Indian Railways data of procurement of stock items for last 4 year was studied. It is observed that-
  o 95% of procurement im value terms in made from approved sources.
  o The significant share of business of these vendors is contributed by Indian railway.
  o Even though individually the contract are lump sum contracts but overall on IR basis the procurement is made from same set of vendors which means- Supplier does not have a long term contract with IR but they have long term business relationship with it. The business with railway has been free from recession so far and there is tremendous potential of growth.
  o Process of vendor approval without considering negotiations on the basis of engineering cost estimation some time creates environment of cartelization, mistrust and corruption.

7. Conclusion:- Area of public procurement is very important from the point of view of its magnitude and objective of spending. Public procurement is estimated as 25-30% of India GDP and on global scale it is estimated to be 15-20% of world GDP. Even though the magnitude and importance is so high, this area has not attracted the much attention of academician for research. There are several pockets of improving supply chain function in the area of public procurement environment. A small improvement can create huge impact in improving efficiency and effectiveness.

8. Reference:- Indian Railways year book 2013,

Swee Siong Kuik, Sev Verl Nagalingam and Yusef Amer, (2001), Sustainable supply chain for collaborative manufacturing, General Emerald vol.22

Emilio Esposito, (2009), Evolution of the supply chain in the Italian railway industry, General Emerald

Jonathan Hanks, Helen Davies, Oshani Perera, (2008), Sustainable public procurement in South Africa, Norad

Autho- Public procurement regulation: An introduction , EUROPEAID

Driving sustainable supply chain management in the public sector: the importance of Public Procurement in the European Union, Emerald group publishing ltd.
Wee Shu Hui, Radish Othman, Normah Hj Omar, Rashidah Abdul Rahman and Nurul Husna Haron, (2011), Procurement issues in Malaysia, General Emerald vol.24


Gary A Smith, (2011), Leveraging private sector practices in the public sector, AGILE business media

Dr.Ilkka Sillanpaa, Koneeranes Oyj, Finland, Dr. Pekka Kess, (2011), Supply chain performance measurement framework for manufacturing industries-A theoretical approach, MIC


Jussi Halme, Global supply chain management and performance measurement, LEKA literature review

Emilio Esposito, Renato Passaro, (2009), Evolution of the supply chain in the Italian railway industry, General Emerald vol.14/4

G P Kurien, M N Qureshi, (2012), Performance measurement systems for green supply chains using modified balanced score card and analytical hierarchical process. Scientific Research and Essays Vol.7(38)


Laurie Kaye Nujaki, Gabriela Worrel, (2011), Procurement for sustainable local economic development, General Emerald vol.25


Kelvin Zuo, Regan Potangaroa, Suzanne Wilkinson and James O.B. Rotimi (2009), A project management prospective in achieving a sustainable supply chain for timber procurement in Banda Aceh, Indonesia, General Emerald vol.2

Byon Keating, Ali Quazi, Antom Kriz, Tim Coltman (2008), In pursuit of a sustainable supply chain: insights from Westpac Banking Corporation, General Emerald vol.13/3

Marie-Cecile Cervellon and Anne-Sophie Wernefelt (2012), Knowledge sharing among green fashion communities online, General Emerald vol.16

Craig R Carter, P Liane Easton, (2011), Sustainable supply chain management evolution and future directions, General Emerald vol.41
Asoke Dey, Paul LaGuardia and Mahesh Srinivasan, (2011), Building sustainability in logistics operations: a research agenda, General Emerald vol.11

Wendy Stubbes, Jan Schapper, (2011), Two approaches to curriculum development for educating for sustainability and CSR, General Emerald vol.12

Philip Beske, (2012), Dynamic Capabilities and sustainable supply chain management, General Emerald vol.42

Glenn Parry, Mike James-Moore, Andrew Graves, (2006), Outsourcing engineering commodity procurement, General Emerald 11/5

Manish Shukla and Sanjay Jharkharia (2013), Agri-fresh produce supply chain management: a state-of-the-art literature review, General Emerald vol.23

Andrea Chiarini (2013), Designing an environmental sustainable supply chain through ISO 14001 standard, General Emerald vol.24

Helen Walker, Neil Jones (2012), Sustainable supply chain management across the UK private sector, General Emerald 17/1


Chunguang Bai, Joseph Sarkis, Xiaopeng Wei, Lenny Koy, (2012), Evaluating ecological sustainable performance measures for supply chain management. General Emerald 17/1


e-procurement in the United nations

Rebecca Angeles, Ravi Nath, (2007), Business-to-business e-procurement: success factors and challenges to implementation, General Emerald 12/2

Anna Corinna Cagliano, Alberto DeMerco and Carlo Rafele (2011), Using system dynamics in warehouse management: a fast-fashion case study, General Emerald vol.22


Public procurement design: Lessons from the private sector, EL-SEVIER

Lean manufacturing, Wikipedia
Multi criteria decision making approaches for supplier evaluation and selection: A literature review, European journal of operational research, EL-SEVIER

World bank certificate programme in June 2013