Productivity Enhancement through Managing the Supply Chain in Roadways Workshop

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Abstract
The increased globalized competition changed the perception of customers towards quality has enforced the industrial organization to redesign its supply chain. The supply chain management is the challenging issue when it looked to shape from the inception of the material to the final delivery. The management of the supply chain refers to managing all the activities within the supply chain so that it benefits all the partners of the supply chain. In the present work, a case of roadways workshop supply chain has been considered to enhance the overall effective utilization of the available resources. It has been found that the supply chain of the workshop is somehow disintegrated as the supply, information and material flow were found to be distorted. The present study provides the inclusive recommendation to the general managers and other associated members that if implemented with due attention leads to productivity and profitability of the case workshop.

Keywords: Supply Chain Management; Productivity; Performance measure; Supply Chain; Material management

1. Introduction
The stiff market competition, depletion of the natural resources, customer demands for numerous variety have enforced the organization to relook their entire supply chain (Jia et al., 2020). The supply chain starts from the inception of raw material, manufacturer, work in process, dispatching and final delivery to the customer (Lambert and Enz, 2017; Kaswan et al., 2019). The typical definition of the term supply chain management is as follows: The supply chain management (SCM) is the integration of all the activities from the purchasing of the raw material till its delivery to the intended customer. In essence, SCM is the coordination between the supply and demand among its various partners for the optimum utilization of the resources (Geng et al., 2017; Singh et al., 2019). There are five major supply chain drivers as depicted in figure 1.

1. Production: This driver of the supply chain is related to determine how much to produce, where to produce, how to manufacture and what to produce. To cope with the voice of the customer demand and efficient utilization of scarce resources of the organization are the prerequisite for the success of the entire supply chain.
2. **Inventory:** The inventory is considered both as evil and boon. The supply chain decision related to inventory and its control can be like, quantity to be stored, safety level, lead time, etc.

3. **Location:** The location decision is a key prospect for the success of the entire supply chain. The location decision can be like, where to build the plant, where to locate a warehouse facility, etc. The location-related decisions may have a substantial effect on the underlying forces of the entire supply chain.

4. **Transportation:** The supply chain transportation decisions are somewhat related to location decisions also. The near plant and warehouse location lead to reduced transportation costs. The decision like the mechanism used to move parts from one to another, economic and rigid mode of transportation are made at this stage.

5. **Information:** The strategic decision in the entire supply chain for effective operations depends on how well the information flow within the entire supply chain of the particular product. The realistic information sharing among the partner provides a long term bond among the partner and hence information is considered as an integrator of the supply chain. The distorted information from the downstream towards the upstream of the supply chain leads to the pile-up of inventories called a bullwhip effect.

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**Figure 1: Major drivers of supply chain**

The main goal of the modern supply chain is to increase productivity and efficiency without compromising the sustainability dynamics (Rathi et al., 2016; Tiwari et al. 2018). Supplier interest, cost quality technology affect the supply chain revenue. Now a day’s industries have to become competitive for their survival. Competition in industries has increased with the development of faster means of communication and customer awareness. To become competitive, the industries have to supply the product at a reliable and reduced cost. The main aim of the
current research is to estimate the current management level of the workshop of roadways bus and enhance the productivity of the current supply chain through better management of the overall resources of the case workshop. The present research work has been organized into five sections including the introduction. The 2\textsuperscript{nd} section depicts the literature review. The methodology has been presented in the 3\textsuperscript{rd} section of the manuscript. The results and discussion of the present work have been depicted in the 4\textsuperscript{th} section. The final section of the manuscript id devoted to the prospective, limitation and future scope of the present research work.

2. Literature Review
The literature review section depicts the various advancement in the supply chain various performance measures and the identified gaps from the previous study. Lee (1992) has shown in his study that the principles of design lead to better product realization. Pettit et al. (2019) summarized SCM as “all the activities involved in delivering a product from raw material through to the customer, including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities”. According to Li et al. (2006) the supply chain management activities lead to economic enhancement among all the partners of the supply chain. Genovese et al. (2017) found out the integration among all the partners of the supply chain is the most essential due to changing market patterns, uncertainty and shorter lifecycle of the products. Wang et al. (2016) have found for the successful execution of supply chain projects the information flow is the major boosting force. Cousins et al. (2019) revealed the integrated function among the entire partner and real-time data sharing with integrity are the potential factors for increase economies of scale. The industrial organization in the modern era are shifting their profitability dynamics toward eco-friendly and sustainable products that demand for the incorporation of sustainability in the whole supply chain (Cucciella et al., 2012; Vanalle et al., 2017) Furthermore, Dubey et al. (2017) depicted that supply chain links all the department and related vendor within the entire supply chain. The main enablers or SCM is that the complete process must be considered as an entire single entity (Gollagher et al., 2011; Rathi et al., 2016). Suryanto et al. (2018) claimed that to remain sustainable in the competitive market the supply includes the customer's valuable support and insights. In this context, the philosophy of SCM turns into the implementation of supply chain management: a set of activities that carries out the philosophy. The idea is to create as much cross-functional teaming and coordination as possible to reduce costs, standardize, simplify, reduce inventories and maximize profits from assets (Sarkis et al., 2011; Wilding et al., 2011; Nunes et al., 2020). Kaswan and Rathi (2019) showed that incorporating sustainable development approaches like Green lean Six Sigma, in the long run, will increase the profitability dynamics of the industry. Waters and Rinsler (2014) have found that the risk focus is not a recent but a key looking factor to manage the supply chain for a sustainable supply chain. Govindan et al. (2014) have been viewed as the key (physical) link between a company’s internal supply chain activities and its customers. More recently, managing the modern demand of customers has been seen as key enablers for the successful
management of the supply chain (Diabat and Govindan, 2011; Zhu et al., 2013; Rathi et al., 2015). Although a lot of works have done by the researchers to manage the different kinds of the supply chain and managing various interlinks among all the intended partners. The literature lacks enough evidence of the management of the supply chain of the workshop. This ambit in the literature provides the motivational value to conduct this study to increase the efficacy and profitability dynamics of the workshop supply chain.

2.1 Research gaps
Supply chain management is a collaborative strategy to link crosses enterprise business operation, which helps visualize, study, secure and share market opportunities and mutual benefits in a competitive environment. The industrial organization through better management, cross functions teams and strategic collaboration with all the partners can take the competitive advantage in the long run. In the literature, no study exists on the productivity enhancement of the supply chain in the roadways workshop. So, these identified research gaps provide an impetus for the present research work.

3. Research Methodology
The systematic research methodology adopted in the present research work is shown in figure 1. The authors have conducted a comprehensive literature survey from the electronic database of the renowned data base. From the literature, the researchers have found the gaps that permit for the problem formulation. The major problems in three pertain regarding the management of the supply chain were found in three areas: i) material ii) finance and iii) information flow. The figure 2 depicts the research methodology adoted in the present work. The major problems in these three distinct areas were recognized and addressed through systematic management of the workshop's entire supply chain. Based on, an inclusive study of the entire supply chain recommendations was suggested to the mangers of the workshop for the increment improvement in the productivity and profitability of the workshop.
4. Results and Discussion

4.1 Material Flow
The total items are approximately 4000 of various models of Tata and Leyland buses. As the number of items is very large, these have been segregated into 67 nos. of groups. The quantum of inventory holding of each group of items varies from 2-3 month keeping in view the operational and maintenance requirement, annual usage value, rate of consumption and lead time from the approved sources. Further, the item of all 67 groups has been classified in the following six categories for prescribing their mode of purchase. Earlier there was no purchase policy
framed by the department for the purchase of various items of spare parts, tires and oil, and lubricants, etc. used for the repair and maintenance of buses of Haryana Roadways depots. Now the fresh purchase policy for the purchase of various items of spare parts, tires, and oil, lubricants, etc. has been framed duly approved by the Govt. so that the items of spares parts are purchased only from the standard firms, time and procedure for issuing tender be known to everybody and also to remove several other problems.

The purchase Policy famed is detailed as under

![Inter-organisation Supply Chain](image)

**Figure 3: Inter organization supply chain**

### 4.1.1 Quantum of Purchase

The approximate annual purchase value of Tyres, Tubes, Flaps, Tyres Retreading material and spare parts for Tata & Leyland Model buses of Haryana Roadways is Rs. 50.00 Crores. Table 1 depicts breakup of purchase material of the workshop.

<table>
<thead>
<tr>
<th>Material</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tires, Tubes &amp; Flaps</td>
<td>Rs. 16.00 Crores</td>
</tr>
<tr>
<td>2. Tyres Retreading Material</td>
<td>Rs. 4.00 Crores</td>
</tr>
<tr>
<td>3. Spare Parts</td>
<td>Rs. 23.00 Crores</td>
</tr>
<tr>
<td>4. Oils &amp; Lubricants</td>
<td>Rs. 7.00 Crores</td>
</tr>
</tbody>
</table>

**Table 1: Quantum of Purchase**

### 4.1.2 Material receiving procedure

Few suppliers prefer transportation mode and few firms supply with their vehicle

- Material is first received by chief storekeeper (CSK)
- Constitute committee inspected the component received whether they are according to the demand placed
4.1.3 Consumption of items in store

Suppose the bus comes in the workshop due to its leaf spring failure. The driver of the bus gives information about the failure to the foreman.

- The driver fills the job card about the faults
- Job card will go to the mechanic
- The mechanic checks the bus
- If repairable than repair it
- Otherwise, replace with the new leaf spring
- The problem is shown to the super wiser
- Store issue slip for the new component
- Slip signed by super wiser, given to the chief storekeeper (CSK) and take the new part from the store
- Fit it into the bus in the supervision of the super wiser
- After repair mechanic will issue the fitness certificate for roadworthy
- Old part deposited to the tool room clerk (TRC)
- The old part will be quotation in open with official procedure

![Material flow in an organization](image)

**Figure 4: Material flow in an organization**

4.2 Information flow

In modern supply chain management information replaces inventory (Securing, 2103; Rathi et al., 2015). Although this statement is not true because the organization needs a product at some point, not just information. The information does change the way the supply chain is managed and these changes lead to lower inventory
(Fernandes et al., 2017; Grant et al., 2020). Without IT (information technology) likely, supply chain management would not possible at all the level it is currently being accomplished.

4. **2.1 Coordinating daily activities:**

Various activities are done daily in the workshop. Which is the following?

- Most buses are checked daily.
- The cleaning of buses is done daily.
- Washing of the buses is done daily.
- Oil and water checked daily.

4. **2.2 Time basis activities:**

Various activities are done on a timely basis in the workshop. Which are the following?

- Tire change after 150000 km. A new tire will go for resoling after covering 50000 to 70000 km generally.
- Lubrication oil change after 18000 km.
- Differential oil change after 72000 km.
- Greasing is done after 2000km.
- Engine overhauling is done generally after 400000 km.
- The battery will be replaced after 2 years.

4. **2.3 General procedure**

If any vehicle breakdown on route due to mechanical failure or any other reasons

- The operator of the bus will give information to the duty section by telephone to the corresponding depot.
- After receiving the message they will write the problem of the bus and given it to the foreman.
- To attend the bus the foreman will send the mechanic with the necessary tool and spare parts which need.
- If the repairable vehicle is sent to the route to cover full rotation.
- If not repairable than taken to the workshop.

4. **2.4 Communication with drivers and management:**

- Generally, communication with drivers is done through phone and or some time in writing through the duty section.
- The duty section is managed for the duties in which a duty inspector and five duty clerk which is the rank of sub-inspector.
- In the position of an accident than traffic, the branch attends first. They provide the inspector and sub-inspector to attend the accident place and also report about the guilty.

4. **3 Money or Cash flow**

**Source:** budget allotted by the government to the depot of roadways for separate work e.g.

- Purchase of new buses for the depot.
Purchase of the spare parts.

For insurance etc.

Purchase of various components of the buses required for the repair.

4.3.1 Purchase at depot level

The General Managers of the depots shall be restricted to make the purchases at their level as under:-

- Oils & Lubricants on monthly basis as per their requirement from the sources decided by the HPPC and instruction issued from the Head office.

- Spare parts only in an acute emergency from the approved source as decided by the HPPC only to meet the emergent requirement for 1-2 weeks in case of non-supply from the firms against regular orders within their financial power i.e. Rs. 10000/- for a single item at a time against rate contract/approved sources.

- The spot purchase of petty/miscellaneous items other than spare parts up to Rs. 500/- without quotations but subject to the purchase of Rs. 5000/- in a year. The purchase of items against quotations up to Rs. 1000/- for a single item at a time but subject to Rs. 35000/- in a year. These items should not be purchased more than 2 months requirement at a time and there shall be no surplus stock of any item in the store.

4.3.2 Passing of bill of material

- Items are received with the bills in the store.

- CSK puts the bills into the office of store ledger assistant (SLA) in the SLA branch to check the record of the received items if the items are received as per the bill than he sent the bill to the store purchase assistant (SPA).

- After receiving the bills SPA checks the rate of the bills as per the order of the headquarter or RC (rate contract) than he signed the bills from the works manager and SPO store purchase officer.

- After that, he puts the bill for audit.

- Junior auditor checks the bill and admitted to the resident section officer.

- After checking he put up the bill to the accounts officer (A.O).

- He sends the bills to the general manager.

- General Manager signs the bill and the bill will be passed.

- SPA sends to the accounts for the payments to the firm.

- Accounts branch pass the bills from the treasury and sent it to the cash branch for the draft and after that, it is sent to the firm.
Table 2: Detailed Expenditure 2013-2014

<table>
<thead>
<tr>
<th>Particulates</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fleet position</td>
<td>167</td>
<td>164</td>
<td>171</td>
<td>178</td>
<td>176</td>
<td>176</td>
<td>176</td>
<td>169</td>
<td>178</td>
</tr>
<tr>
<td>2. Workshop receipt (lacks)</td>
<td>21.75</td>
<td>6.67</td>
<td>1.10</td>
<td>22.05</td>
<td>4.84</td>
<td>8.43</td>
<td>20.61</td>
<td>1.62</td>
<td>7.52</td>
</tr>
<tr>
<td>3. Spair parts (p.k.m)</td>
<td>0.37</td>
<td>0.39</td>
<td>0.46</td>
<td>0.46</td>
<td>0.17</td>
<td>0.38</td>
<td>0.46</td>
<td>0.45</td>
<td>0.98</td>
</tr>
<tr>
<td>4. Battery</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.02</td>
<td>0.03</td>
<td>0.01</td>
<td>0.00</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>5. Leaf spring</td>
<td>0.02</td>
<td>0.03</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
<td>0.01</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>6. Body work</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>7. Total w/s expenditure</td>
<td>0.93</td>
<td>1.33</td>
<td>1.29</td>
<td>1.21</td>
<td>1.04</td>
<td>1.39</td>
<td>1.05</td>
<td>0.92</td>
<td>1.32</td>
</tr>
</tbody>
</table>

5. Conclusion and Perspective
The supply chain management is at the heart of the profitability and productivity of the industrial organizations. In the present work, a case of the Haryana roadways workshop has been realized to manage its distinct operations. In the workshop, a study was conducted in four areas. During the study, some drawbacks were found and based on the same relevant suggestion were made to the workshop managers. By selecting trustworthy suppliers that provide the required amount of material in the given time the organization can take advantage of the best space utilization and prevention of spoilage of stock. Through more purchasing powers to the general manager for emergent needs, the purchasing of material can be made more efficient. The bill passing procedure is very lengthy which leads to delay in processing. So, the most important suggestion is that the employee should be properly trained and experienced so that higher work efficiency leads to better service and less waiting in the queue to be repaired.

In offing, IT can be implemented where it makes the crucial decision at strategy, planning, and operation. The complaints can be received through the net and this conformation can be accessed by the works manager. With this accessibility, the manager can decide to improve for the returned products. So that the complaint does not repeat further. This helps the manager to take immediate action and decrease furthermore complaints from the customers.
The main limitation of the present research work is that the present case has been realized in a single workshop of the buses. So, all the findings cannot be realized for the entire workshops but this provides the guidelines for other workshops to be more effective and efficient. In future studies, the researchers may focus on some grey areas of supply chain management like the modeling of the energy-efficient workshop supply, scheduling pattern of the buses of the workshops.

References


