BENCHMARKING INTERNAL SUPPLY CHAIN PERFORMANCE: DEVELOPMENT OF A FRAMEWORK

Harjit Singh¹, Anish Sachdeva², Gurpreet Kaur³

¹Department of Mechanical Engineering, CT Institute of Engineering Management and Technology, Jalandhar, India
²Department of Industrial and Production Engineering, National Institute of Technology, Jalandhar, India
³Department of Mathematics, Lovely Professional University, India

ABSTRACT

In this paper, a framework is developed for benchmarking internal supply chain performance using financial data as an alternative to traditional approach of use of different models of supply chain performance evaluation. This framework is demonstrated by using the publicly disclosed financial data compiled and distributed in the PROWESS databases maintained by the Center for Monitoring Indian Economy (CMIE). By following this framework, a firm can identify areas of opportunity for improvement in its internal supply chain. Further, the framework can help to identify specific reasons behind the performance levels in the internal supply chain and stimulate performance improvement. To illustrate the framework, it is applied to fast moving consumer goods (FMCG) industry. The framework provides meaningful results for the firms.

Keywords: Supply chain performance, Benchmarking, Fast moving consumer goods (FMCG), PROWESS, Length of supply chain, Efficiency of supply chain, Supply Chain working capital Productivity

I. INTRODUCTION

There has been an increased awareness in recent years regarding the role and potential of supply chain management in supporting corporate goals. Management theorists as well as practitioners have addressed the problem of how to improve supply chain processes. This article is focused to a discussion of the internal supply chain, defined as the flow of materials from the procurement of raw materials to the delivery of finished goods to the customers of an organization [1]. For improving the supply chain performance of a particular firm, it is essential to use performance measures appropriate to its business. Subsequently, it may carry out a benchmarking exercise. Benchmarking is one way of assessing performance based on these measures[2]. Smeltzer et al. tested the relationships among benchmarking, strategic purchasing, and performance of firms and found that benchmarking is positively related to firms performance and strategic purchasing [3].
A number of measurement models was then defined in the 2000s and helped to analyse supply chains in terms of some or all of their components (collaboration, human resource management, sustainability, etc.)[6]. Various sets of supply chain performance measures discussed in the literature, the most widely accepted in the industry is Supply Chain Operations Reference (SCOR) model. It has developed by Supply-Chain Council which is an independent, non-profit, global corporation interested in getting the industry to standardize supply chain terms so that meaningful supply chain benchmarking can be carried out. Supply chain software vendors such as SAP have adopted the SCOR performance measures in their performance management module. The maturity classification proposed in the Supply Chain Operations Reference (SCOR) model relates to companies’ ability to manage the full scope of a supply chain [10]. As per the SCOR model, supply chain performance measures fall under the following four broad categories:

- Cost
- Assets
- Reliability
- Flexibility

The measures related to costs and assets as internal-facing measures, while reliability and flexibility are termed as customer-facing measures. Typically, a firm offers a bundle consisting of price, delivery and flexibility to its customers. Price, in competitive markets, is dictated by the market place. Thus, only delivery and response related measures are termed as customer-facing measures. The performance measures related to assets and costs affect the profitability of the firm and are, thus, termed as internal-facing measures.

Each supply chain evaluation model is not suitable for each and every sector of industry due to some limitations of each of these models. Besides plenty of models, SCOR is most widely accepted model in the industry. Many companies have no measures for their supply chains or they have poor measures. That is incredible given the importance, complexity and scope of supply chains with international sourcing and competitors. Such companies have the supply chains they designed and deserve. Supply chain management excellence is no longer a matter of competitive advantage. It is matter of survival. Meeting and exceeding customer expectations requires it. Firms that do not include supply chain management as a core competency do not lead and do not do a good job. SCOR measures, however, do not capture order delivery lead time and measure related to product variety. So, to that extent, performance measures under the SCOR model do not seem to be comprehensive. Another shortcoming of SCOR model is unlike Western countries, most countries in Asia suffer from the problem of data availability. Even if the relevant data are available, one is not sure of the validity and reliability of the data.

The opportunity analysis tool is used to ascertain how efficiently firms are managing the internal supply chain processes. Financial measures are used to gauge the firm’s operational performance [13].

II. BENCHMARKING FRAMEWORK

This Study is focused on important metrics like cost and assets utilization data, for which data are available in annual financial statements of listed companies. This financial data is also obtainable from database like PROWESS (India) and COMPUSTAT (United States) that provide information in compiled form. The objective of the present work is development of a framework for “benchmarking internal supply chain performance using financial data” that can help to identify specific reasons behind the performance levels in the internal supply chain and stimulate performance improvement. To illustrate the framework it is applied to FMCG (fast moving
consumer goods). The framework provides meaningful results for the firms in the industry. The advantage of this approach lies in the fact that it allows benchmarking using public information. This information is available in financial statements of annual reports and in business periodicals. To demonstrate this framework, publicly disclosed financial performance data, compiled and distributed in the PROWESS database maintained by the Centre for Monitoring Indian Economy (CMIE), were analysed. One can obtain, through these databases, information such as background, share prices, sensitivity index, financials, product profile, raw materials consumed, and accounting policies of the firms. The relevant expressions which are used in this study are shown in Table 1 and these are available in Prowess.

Table 1: Terms directly obtained from Financial Statements

<table>
<thead>
<tr>
<th>Terms from the income and expenditure statement</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of raw materials</td>
<td>CRM</td>
</tr>
<tr>
<td>Cost of Production</td>
<td>CP</td>
</tr>
<tr>
<td>Cost of Distribution</td>
<td>DC</td>
</tr>
<tr>
<td>Cost of Sales</td>
<td>CS</td>
</tr>
<tr>
<td>Net Sales</td>
<td>NS</td>
</tr>
<tr>
<td>Inventories (inclusive of raw materials, semi-finished goods and finished goods)</td>
<td>INV</td>
</tr>
<tr>
<td>Raw material inventory</td>
<td>RM</td>
</tr>
<tr>
<td>Semi-finished goods inventory</td>
<td>SFG</td>
</tr>
<tr>
<td>Finished goods inventory</td>
<td>FG</td>
</tr>
<tr>
<td>Account receivable (excluding loans and advances)</td>
<td>AR</td>
</tr>
<tr>
<td>Accounts payables</td>
<td>AP</td>
</tr>
</tbody>
</table>

In this study the following three parameters of Supply Chain Performance Measures are calculated:

1. **Total Length of Supply Chain:**

   The total length of the chain is arrived at by adding up the days of inventory for raw materials, work-in-process and finished goods remain in the firm. The firm that has the minimum total length of the chain is said to have the best performance. The total length of supply chain is calculated by

   Days of raw material (DRM) = \(RM \times 365\text{CRM} \)

   \(RM = \text{Raw Material Inventory for one financial year} \)

   \(\text{CRM} = \text{Cost of raw material for one financial year} \)

   Days of Work in Process (DWIP) = \(SFG \times 365\text{CP} \)

   \(SFG = \text{Semi finished goods inventory for one financial year.} \)

   \(\text{CP} = \text{Cost of Production for one financial year.} \)

   Days of Finished Goods (DFG) = \(FG \times 365\text{CS} \)

   \(FG = \text{Finished goods inventory for one financial year} \)

   \(\text{CS} = \text{Cost of sales for one financial year} \)

   Total Length of supply chain in days = DRM + DWIP + DFG
The duration of time taken by the material flow is captured by this measure. Firms like Dell Computers perform very well on this dimension.

2. Efficiency of Supply Chain Management:
The internal supply chain inefficiency ratio is a measure of the efficiency of internal supply chain management. To calculate this ratio, total inventory carrying costs and the distribution costs is considered to be the components of the internal supply chain management costs. The Supply Chain Inefficiency Ratio is calculated as:

\[
\text{Supply Chain Management Costs (SCC)} = \text{DC} + \text{INV} + \text{ICC} \\
\text{Supply Chain Inefficiency Ratio (SCI)} = \frac{\text{SCI}}{\text{NS}}
\]

\[
\text{DC} = \text{Cost of Distribution for one financial year} \\
\text{INV} = \text{Total Inventory for one financial year} \\
\text{ICC} = \text{Inventory carrying cost} \\
\text{NS} = \text{Net Sales for one financial year}
\]

The supply chain inefficiency ratio (the lower the better) provides an insight into the internal supply chain management efficiency of the firm. This measure is termed the supply chain inefficiency ratio since the supply chain cost will be higher if there are inefficiencies in the system. Firms with efficient supply chain systems will have relatively lower scores on this performance measure.

3. Supply Chain Working Capital Productivity
The analysis of firm on this metric will also be based on the levels of inventory, accounts receivable and accounts payable. Firms with efficient supply chains will usually have high supply chain working capital productivity.

The supply chain working capital productivity is calculated as:

\[
\text{Supply Chain Working Capital (SWC)} = \text{INV} + \text{AR} - \text{AP} \\
\text{Supply Chain Working Capital Productivity (SWCP)} = \frac{\text{NS}}{\text{SWC}}
\]

\[
\text{INV} = \text{Total Inventory for one financial year} \\
\text{AR} = \text{Accounts receivable (excluding loans and advances) for one financial year} \\
\text{AP} = \text{Accounts payables for one financial year} \\
\text{NS} = \text{Net Sales for one financial year}
\]

A firm can compare its own performance with that of its competitors and that the industry aggregate in order to ascertain where it stands in terms of supply chain performance. Using benchmarking data, a firm can also map a supply chain profile that allows it to effectively capture both the dimensions of time and cost in one diagram. Further, a firm can also compare its own profile with that of competitors in order to ascertain where it stands in terms of costs and length of time in the chain.

In this study the new concept of financial benchmarking is focused, which can help a firm in comparing its supply chain performance with competitors using financial data.

III. COMPARATIVE ANALYSIS OF FMCG SECTOR COMPANIES

In a highly competitive market environment, the relative performance of a firm in sale, market share, and its supply chain depends primarily on its Strategic decisions and financial aspects.
Supply chain effectively makes the firm profitable in one or many ways, either through efficient distribution network or through less cost transactions and well defined information flow.

The top three public firms (A, B and C) from the fast moving consumer goods sector are selected for analysing the supply chain performance. By using the above mentioned methodology, days of raw material inventory, days of work-in-process, and finished goods inventory are calculated for last four years.

### Analysis of Days of Raw Material Inventory

**Table 2:** Days of raw material inventory

<table>
<thead>
<tr>
<th>Year</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>80.47</td>
<td>64.51</td>
<td>45.09</td>
</tr>
<tr>
<td>2012</td>
<td>95.06</td>
<td>69.92</td>
<td>27.02</td>
</tr>
<tr>
<td>2013</td>
<td>66.42</td>
<td>69.08</td>
<td>15.87</td>
</tr>
<tr>
<td>2014</td>
<td>59.44</td>
<td>78.58</td>
<td>16.98</td>
</tr>
</tbody>
</table>

**Figure 1:** Comparison of days of raw material inventory

The days of raw material inventory of company C are very less as compared to Company A and B.

### Analysis of Days of Work-in-Process Inventory:

**Table 3:** Days of work in process inventory

<table>
<thead>
<tr>
<th>Year</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1.66</td>
<td>10.64</td>
<td>1.25</td>
</tr>
<tr>
<td>2012</td>
<td>2.01</td>
<td>11.35</td>
<td>1.35</td>
</tr>
<tr>
<td>2013</td>
<td>5.80</td>
<td>15.42</td>
<td>2.42</td>
</tr>
<tr>
<td>2014</td>
<td>9.53</td>
<td>13.07</td>
<td>2.17</td>
</tr>
</tbody>
</table>
Figure 2: Comparison of days of work in process inventory

The days of work in process inventory for company B are much greater than company A and C and this also affects the overall length of supply chain. The company B has to improve its process to reduce the days of work in process inventory.

Analysis of Days of Finished Goods Inventory

Table 4: Days of finished goods inventory

<table>
<thead>
<tr>
<th>Year</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>24.49</td>
<td>19.20</td>
<td>20.06</td>
</tr>
<tr>
<td>2012</td>
<td>26.75</td>
<td>17.79</td>
<td>18.70</td>
</tr>
<tr>
<td>2013</td>
<td>24.05</td>
<td>10.14</td>
<td>16.06</td>
</tr>
<tr>
<td>2014</td>
<td>27.29</td>
<td>19.06</td>
<td>18.45</td>
</tr>
</tbody>
</table>

Figure 3: Comparison of days of finished goods inventory

Total Length of Supply Chain

Table 6: Total length of Supply Chain in days of all three companies

<table>
<thead>
<tr>
<th>Year</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>106.62</td>
<td>94.35</td>
<td>67.19</td>
</tr>
<tr>
<td>2012</td>
<td>123.83</td>
<td>99.06</td>
<td>47.06</td>
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<tr>
<td>2013</td>
<td>96.26</td>
<td>95.24</td>
<td>34.35</td>
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<tr>
<td>2014</td>
<td>96.26</td>
<td>110.71</td>
<td>37.60</td>
</tr>
</tbody>
</table>
IV. CONCLUSIONS

This article provides the performance measures that can be evaluated through publicly available information. A framework for benchmarking using these performance measures was presented and applied to the FMCG sector industry. By following this framework, firms can identify areas of opportunity for improvement in their internal supply chain. The framework was one of the main benefits of this exercise in that it highlights performance shortcomings in specific areas. Such a practice encourages firms to look outward and gain an external perspective on performance improvement opportunities.

REFERENCES


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