Benchmarking

- Measuring and benchmarking supply chain performance is a vital first step in any reengineering programme.
- Understanding the differences between value adding time and non-value adding time can help identify opportunities for time compression in the supply chain.
- Whilst benchmarking often implies comparison outside the business with “best-in-class” organisations, it can also be a powerful tool for use internally.
One benefit of a rigorous approach to logistics and supply chain benchmarking is that it soon becomes apparent that there are a number of critical measures of performance that need to be continuously monitored.

The idea of key performance indicators (KPI's) suggests that whilst there are many measures of performance that can be deployed in an organisation, it is a relatively small number of critical dimensions which contribute more than proportionally to success or failure in the marketplace.

Because logistics costs can account for a large proportion of total costs in the business it is critical that they be carefully managed.

However it is not always the case that the true costs of logistics are fully understood.

Traditional approaches in accounting based upon full-cost allocation can be misleading and dangerous.

Activity Based Costing (ABC) provides significant advantages in identifying the real costs of serving different types of customers or different channels of distribution.

The key to ABC is to seek out the cost drivers along the logistics pipeline that cause costs because they consume resources.

The advantage of ABC is that it enables each customer's unique characteristics in terms of ordering behaviour and distribution requirements to be separately accounted for.

Once the cost attached to each level of activity is identified then a clearer picture of the true cost to serve will emerge.
Activity-Based Costing (ABC)

A cost management technique which regards the activity cost as a 'building block' to analyse how and to which order, product, customer, etc. the resources are consumed over time.

ABC was introduced by Kaplan and Cooper of Harvard Business School as an alternative to traditional accounting techniques in the 1980s.

Many have since used this method for product costing in both manufacturing and business applications.

The ABC method of accounting involves the breakdown of a system into individual activities and costing of the amount of time and resources spent on each activity in the manufacture of a product.

A schematic diagram to illustrate this point is given in the Figure.

ABC is based on an understanding of how activities consume resources.
Traditional accounting methods concentrate on volume-based costs systems and these methods are highly inaccurate in the modern manufacturing environment.

Today much of the significant cost in producing an item are not volume related, for example, the cost of engineering, order processing, planning, quality control, etc. for high technology, make-to-order products, or just-in-time delivery.

ABC, however, takes into account the cost incurred at activity level and then attributes the cost to products according to the activities that a product goes through.

Even with a simple case, ABC can be very complex and time-consuming, that is why it is not widely applied in the manufacturing industry.

It is recognized that ABC can be used to enhance rather than replace the accounting system when the company finds it too difficult to implement full-scale ABC-based accounting.

In this case, ABC is used as a cost management tool by the operational departments to compliment the existing accounting practice.

In ABC cost pools must be identified for each activity.

The cost is incurred once the product passes through the activity.

The factor that causes the cost to be incurred in the activity is known as the cost driver.

The development of an ABC model is relatively simple. The accuracy usually depends on how detailed the ABC model and the type of cost driver used. Developers have a choice of three types of activity cost drivers which are, in order of increasing accuracy (and cost of measurement):
- **transaction drivers**
  which count each time an activity takes place;
- **duration drivers**
  which represent the time taken for each activity and so takes into account variation; and
- **intensity drivers**
  which directly cost for the resources used each time an activity takes place.

- ABC systems relate organisation spending of resources to the activities and business processes performed by these resources.
- Activities can be classified into four general categories
  - **Unit Level** – performed each time a unit is produced
  - **Batch Level** – performed each time a batch of goods is produced
  - **Product Level** – performed as needed to support the production of each type of product
  - **Facility Level** – performed to sustain the factory’s performance such as rent, depreciation, insurance etc.

- In ABC variable overhead costs are traced to individual products however it is not always straightforward to assign fixed overhead costs to unit drivers.
- ABC systems have the advantage of associating many of the costs that are defined in traditional costing systems as fixed overheads with changes other than production volume.
ABC therefore helps to clarify the relationship between the causes of cost increase and decrease and the individual products.

It is this cause and effect relationship which allows management to differentiate between value added and non value added activities. ABC systems therefore have the potential for Strategic Decision making tool for process redesign and continuous improvement.

Cost Accounting vs. ABC
- An Example: Product Costing

Cost Accounting: Material Cost + Labour rate x product volume + Overhead rate x product volume

Activity-Based Costing: Material Cost + Cost of Activity 1 + ... + Cost of Activity n

ABC provides a more detailed, timely and accurate allocation of the cost factors and value to the product.

Product Costing - Cost A/C

Indirect Cost

Overhead Rate

Not effective for cost management:

- Including indirect cost in overhead hide the non-value added activities
- Indirect cost is far more than the direct labour cost for electronics manufacturers
- No distinction of cost of design, engineering, quality, business process, etc.
Activity cost is a meaningful link between products and the resources they consume.

ABC v Traditional Accounting

Cost Accounting
- too late: most cost reports are at accounting period, e.g. end of the month
- too aggregated: aggregate to simplify, not enough for cost management
- distorted cost allocation: only direct material/labour are traced. Engineering, planning, & sales cost are averaged out although they may be direct causes to a product, order, etc.

ABC
- immediate: on request by cost management or by improvement project
- detailed: costing at the same level as operating management: activity
- linking cost cause-effect via activity: allocate cost to activity, and then analyse and manage cost of the activities which contribute to the product, order, etc.

Application of ABC
Activity Costs are ‘building blocks’ for many forms of management information.
To sum the cost of all the activities that contribute to make the product:

- (1)

2. To calculate inventory value/cost

To sum the cost of all the activities that have taken place to make it:

- (2)

\[ C_i = \sum_{j=1}^{N_i} C_{ij} \]
\[ W_i = \sum_{j=1}^{K_i} W_{ij} \]
\[ M_i = \text{material cost of the } i\text{th product} \]
\[ C_{ij} = \text{cost of the } j\text{th activity in making the } i\text{th product} \]
\[ N_i = \text{total number of activities to make the } i\text{th product} \]
\[ K_i = \text{number of activities that have taken place to make the } i\text{th product} \]

Resources that are unused can be for other tasks, i.e. surplus capacity:

- (3)

\[ S_i = \sum_{j=1}^{N_i} \left( C_{ij} - W_{ij} - M_i - C_{ij} \right) \]

4. To simplify and improve process

Categorising the cost by activity type help identify the high-cost activity type to simplify or improve:

- (4)

\[ S = \text{surplus capacity} \]
\[ T_c = \text{total capital investment & operating cost to the process} \]
\[ m = \text{total number of products been produced} \]
\[ k = \text{total number of activity types} \]
\[ C_{xy} = \text{cost of the } y\text{th activity in the } x\text{th activity type} \]
\[ L_x = \text{total number of activities of the } x\text{th activity type} \]

5. Business Process Reengineering (BPR)

ABC stimulates BPR by identifying the high-cost activity in a business process, and help cost-benefit analysis of BPR by measuring the cost of activities that are productive.

6. To analyse cost-benefit of QA

Defective products should be scrapped as early as possible. However, it is costly to devise many QA in the process. ABC can quantify the activity cost required to continuously manufacture the defective products vs. the investment on QA, thus providing quantitative information to support decisions.
Application of ABC

7. To justify investment of Automation
   Automation improves efficiency but requires high capital investment. ABC can quantify the improved product cost vs. the automation investment, thus helping analyse the cost-benefit.

8. To maximise profitability
   To select the product with the max. profitability as calculated below:
   
   \[ P_i - \sum_{j=1}^{N_i} CA_{ij} = \max \]

   \( P_i \): the selling price of the \( i \)th product
   \( CA_{ij} \): cost of the \( j \)th activity in making the \( i \)th product

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Issues to Consider in ABC

1. Where will ABC be applied?
   - A great amount of data needs to be collected and updated for ABC. It is easier to implement by functions.
   - It works best in functions where fairly discrete, repetitive activities take place:
     - Manufacturing Process: production, QA, store, handling & shipping of items with long time or large volume
     - Business Process: sales/plan, purchase

---

Issues to Consider in ABC

2. At which level will the activity be?

<table>
<thead>
<tr>
<th></th>
<th>Accuracy of cost</th>
<th>Detail of data</th>
<th>Allocate Procedure cost</th>
<th>Line</th>
<th>Work centre</th>
<th>Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>simpler</td>
<td></td>
<td>closer to exist A/C</td>
<td>simpler</td>
<td></td>
<td>more accurate</td>
</tr>
</tbody>
</table>
**Issues to Consider in ABC**

3. What cost factors will be included?

<table>
<thead>
<tr>
<th>Update data on time</th>
<th>Allocate cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct to activity</td>
<td></td>
</tr>
<tr>
<td>- Direct labour</td>
<td></td>
</tr>
<tr>
<td>- Machine/Tooling</td>
<td></td>
</tr>
<tr>
<td>- Utilities</td>
<td></td>
</tr>
<tr>
<td>Indirect to activity</td>
<td></td>
</tr>
<tr>
<td>- Computers</td>
<td></td>
</tr>
<tr>
<td>- Maintenance</td>
<td></td>
</tr>
<tr>
<td>- Consumables</td>
<td></td>
</tr>
<tr>
<td>- etc.</td>
<td></td>
</tr>
</tbody>
</table>

more difficult relationship

difficult more relationship

**Allocate Cost to Activity**

- An Example

**Activity: Testing**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources Required:</td>
<td>Utilities</td>
<td>Machine</td>
<td>Tooling</td>
</tr>
</tbody>
</table>

A simplified model of an automated test activity to illustrate that the activity cost is calculated by resource consumption

<table>
<thead>
<tr>
<th>Cost Driver</th>
<th>Step 1 Waiting</th>
<th>Step 2 Setup</th>
<th>Step 3 Testing</th>
<th>Activity (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct labour (C1)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Depreciation Machine (C2)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Tooling (C3)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Utilities (C4)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
<td></td>
</tr>
</tbody>
</table>

**Activity cost:**

\[
CA = C_1 T_2 + (C_2 + C_3)(T_2 + T_3) + C_4(T_1 + T_2 + T_3)
\]
The Balanced Scorecard
Kaplan and Johnson in their book *Relevance Lost* attacked corporate reporting systems saying that they were too oriented towards meeting the needs of the stock market, and that this was a major reason why Western manufacturing was losing out to Japan.

For too long, performance measurement has been dominated by:
- backward looking and
- financial measures of performance.

**Balanced Measures?**

<table>
<thead>
<tr>
<th>Traditional</th>
<th>Balanced</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- size of circle indicates number of measures

- Obviously what are needed are both financial and non-financial performance measures, looking forward as well as back.
- The balanced scorecard developed by Kaplan and Norton is now widely regarded as being a significant advance in performance measurement.
- This approach develops a methodology for a balanced set of measures, whereby financial are but one element.
- According to Kaplan and Norton there are four aspects that any measurement system needs to cover.
These are:
- Financial
- Customer (or externally) oriented
- Business Process (or internally) oriented
- Learning and Growth
- All are necessary

Moreover, there is a logic that sees financial performance emerging from customer understanding, from internal operations, and these last two being sustained by learning and growth.

The figure gives examples of generic measures and their relationships.

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The Balanced Scorecard

- **Financial perspective**
  - return on capital employed
  - cash flow
  - profit
  - turnover per employee

- **Customer perspective**
  - customer satisfaction index
  - market share
  - percentage sales from new products
  - delivery performance

- **Internal business perspective**
  - tender success rate
  - ppm levels
  - cycle times
  - inventory turns
  - OEE

- **Innovation and Learning perspective**
  - time to develop new products
  - % revenue from new services
  - number of employee suggestions
  - successful platform derivatives

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- The concept of the Balance Scorecard is that there are a number of key performance indicators - most of them probably non-financial which will provide better means of meeting strategic goals than more traditional financial measures.
- The KPI’s derive from the strategic goals themselves.
- Thus the intention is that the balanced scorecard will provide ongoing guidance on those critical areas where action may be needed to ensure the achievement of those goals.
Kaplan and Norton maintain that the measures should be capable of telling the story that is that they should from a logical sequence showing how learning and growth lead to operational growth, which is both assisted by customer and market orientation, which finally result in financial return to shareholders.

Such a framework can be both top down and bottom up, with participation at all levels.

Whilst the balanced scorecard is useful, many manufacturing and operations-based companies base their measurement systems on the central issues of the business which are cost, quality, delivery, people, suppliers, markets and new product introduction.

The DTI recommend 7 measures: defects per million, units per operator hour, inventory turns, delivery achievement, OEE, value added per person, and turn over per floor area.

These measures can be fitted into a balanced scorecard approach.

It is important to measure the process rather than the function.

These ideas transfer readily into the management of the supply chain.

If suitable performance measures can be identified that link with the achievement of these strategic goals they can become the basis for a more appropriate scorecard than might traditionally be the case.

A logical four-step framework could be:
1. **Articulate logistics and supply chain strategy** – how does supply chain strategy contribute to the overall achievement of corporate and marketing goals.

2. **What are the measurable outcomes of success** – typically these might be summarised as better, faster, cheaper. In other words superior service quality, achieved in shorter time frames at less cost to the supply chain as a whole.

3. **What are the processes that impact these outcomes** – in the case of better, faster, cheaper, the process that lead to perfect order achievement, shorter pipeline times, and reduced cost-to-serve need to be achieved.

4. **What are the drivers of performance within these processes** – these activities are the basis for the derivation of the key performance indicators. Cause and effect analysis can help in their identification.

- In this framework it is suggested that the three key outcomes are: better faster; cheaper.
- This triad of interconnected goals is almost universal in its desirability.
- These goals are significant because they combine a number of customer based measures of performance in terms of total quality with internal measures of resource and asset utilisation.
- The figure highlights the customer facing, process orientation of this concept of performance measurement.
Creating a Logistics Scorecard

- Better: Service Quality → Perfect Order Achievement
- Faster: Time → End-to-End Pipeline Time
- Cheaper: Cost → Cost-to-serve

- Since "what gets measured, gets managed" it is inevitable that once measures such as these are put in place, management attention will be directed to these key issues.
- The role that benchmarking plays is pivotal.
- In the first place it helps identify what current best practice is and the focuses on how processes might be reengineered and managed to achieve excellence in these critical competitive areas.

Balancing Activity Based Management

- Cost
- Process Control
- Yield Management
A variation of the balanced scorecard approach, developed by the University of Cambridge, sees performance measurement in terms of an input/output model.

Here there are six groups of necessary measures: suppliers, customers, internal processes, people, learning and innovation and financial achievement.

WHAT TO MEASURE?
6 Starting Points for Performance Measures

**ENVIRONMENT**
- Environment
- Community
- Ethics
- Employee family

**FINANCIAL PERFORMANCE**
- Profit
- ROI / ROCE
- Cash Flow
- Value Added

**PROCESS**
- Cost
- Quality
- Time
- Productivity
- Throughput
- Inventory
- Product contribution

**OUTPUT**
- Delivery
- Customer satisfaction
- Service

**INNOVATION and LEARNING**
- Time to market
- Product age profile
- Continuous improvement
- R&D

**INPUTS**
- Cost
- Quality
- Delivery

**PRODUCTIVITY**

Productivity

Yield

Cost