

# SUPPLY CHAIN PERFORMANCE MEASUREMENT

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Initiated by Erik Juul Rasmussen, the previous three issues of the SBR have given us an in-depth look at modern brewery supply chain management. In this issue, we continue with the fourth article in this series where Dr Nevan Wright, AUT University, Auckland, New Zealand, gives us an insight into supply chain performance management.

The ultimate performance measurement of any organisation is made by investors, the share market, and financiers. Failure to provide a satisfactory return on investment will lead to a drop in share price and higher funding rates and the organisation will be under pressure to cut back on costs, close plants and to reduce staff numbers. At the functional level, the key measurement of the marketing department is market share, and other measures are: orders on hand, order lead time, repeat business, number of complaints, new product development, time to market of new product, conversion of new product to sales and so on. None of this can happen without operational performance. Operational measures are either in terms of utilisation or performance. In turn, operational performance is dependent on the effectiveness of the supply chain.

For a good deal of the 19th and for all of the 20th century, accountants were the conduits of information for performance measurement. Accountants look at results to measure what **has** happened and whether plans and targets (budgets) **have been** achieved. Although operations managers are vitally interested in results, they also use measurement to **influence and control** so as to **achieve** desired results (rather than to measure what has happened).

## OPERATIONS UTILISATION MEASURES

- Plant** Output/throughput per hour
- Usage %
- Capacity % used
- Space occupied
- Downtime (repairs, cleaning, service/maintenance)
- Plant capital cost (depreciation or lease cost)
- Changeover/setup time

- People** Output/throughput per hour
- Capacity % used
- Idle or ineffective time
- Absenteeism
- Accidents/illness
- Labour cost content

- Materials** Yield %
- Waste/damage %
- Cost

- Performance;** areas to be measured
- Location; Transport costs
- Layout; Movement and throughput
- Space utilisation

- Work methods;
- Value added per hour
- Accident rates
- Industrial disputes
- People, numbers and skill levels
- Employee turnover

- Capacity management
- Capacity available measured in possible output and
- Capacity % achieved

- Scheduling
- On-time deliveries
- Value/amount of production in progress
- Customer delivery time

- Materials management
  - Supplier performance (quality and on-time delivery)
  - Stock turn, days of stock held (input materials and output stocks)
  - Capital tied up in stock
  - Shortage of material
  - Wastage
- Quality
  - Reject rates
  - Returns from customers
  - Customer complaints
  - Quality system costs
  - Product tests/laboratory costs
- Maintenance
  - Downtime
  - Cost of own maintenance staff
  - Plant utilisation

terms of meeting specification, correct quantity, on time and at the ‘right’ price. Downstream, the brewer will measure reliability of distributor or third part logistics operators. Measurement in theory will be two-way, but frequently measurement is self-centred and little effort is made to measure performance from the perspective of 1st tier suppliers or from the distributors’ perspective, let alone try to measure performance for the whole supply chain! Of course, large brewers spend much time, effort and marketing dollars to influence downstream to retailers and end consumers and are vitally concerned with market share.



Figure 1

All of the above performance measures are at one level of the supply chain, be it supplier, brewer, distributor or retailer. Obviously, the immediate upstream provider will have an impact on the performance of the next level of the supply chain and the performance of each downstream supplier will likewise affect the overall efficiency of the supply chain as a whole.

In the simplified supply chain shown in Figure 1, one component of the chain, the brewer, measures own performance and the performance of immediate suppliers and distributors. Suppliers performance will be measured on their delivery of materials in

The philosophy of the supply chain movement is to recognise that organisations are not an island unto themselves. Organisations are inter-dependent on other organisations up and down the supply chain and need to recognise financial as well as logistical limitations and advantages of inter-company (including inter-national) transactions. Some organisations have achieved integration of their supply chain to an advanced level from a position of dominance and power (Wal-Mart in the USA, Tesco in the UK and McDonalds world-wide). →

Toyota might not seem to have much in common with the brewing industry; however, it is worth considering the Toyota way. Toyota require internally a flexible work force, single minute exchange of dies, small batches, elimination of non value adding activities, scheduling to balance the line and to reduce queues, simple easily understood control measures and feedback, and minimal stock holding. Continuous improvement (kaizen) is so engrained in the culture that Toyota staff are not aware of any other way of thinking! Being internally efficient is crucial to a lean system, but no lean system is possible without the co-operation of suppliers and customers. Toyota provides controls and standards on suppliers out to several tiers of their supply chain and distributors down to the car sales yards. They insist on, and measure, quick response, delivery on time, delivery exactly to specification (with up to 16 hourly deliveries required per day) from immediate suppliers to the production plant. Performance of all of this requires shared values, standards, targets and measures. Toyota does not neglect customer satisfaction. From the customer aspect, performance is measured two ways; from internally set standards of product quality, on-time delivery and service and externally from feed-back from each downstream member of their supply chain. Despite all this, Toyota is not perfect and is prepared to publicly admit so. Following recent well publicised recalls, the Toyota president stated that ‘the world class quality we have built is our life line. There will be no growth without an improvement in quality. This is the biggest task that this management must undertake’.

A little more than a decade ago business schools and management journals were urging industry to attain ‘world class’ performance. As a result, departments within organisations strived to achieve ‘islands of excellence’ using a succession of operational excellence initiatives (e.g. TQM, MRPII, and Six Sigma). Barriers between departments were gradually demolished. Additionally, organisations started to become customer focused and established performance metrics in all areas of the business. However, the business model and the performance metrics were generally site-centred or at best were confined within the company or enterprise. The need for externally focused performance metrics from the perspective of

a customer or an external supplier may have been included in the Chairman’s annual report but were seldom implemented.

In the 21st century, web-based collaborative agile supply chains have become possible, see ‘Lean and Agile Supply Chains’ in the August issue of this journal. A collaborative agile supply chain requires an organisation to work sometimes with an ‘enemy’ and does not aim to achieve business success at the expense of a competitor. The characteristics of an agile supply chain are quick customer response at each level of the chain, flexibility, scheduling triggered by customer demand, open and real time information flow, simultaneous new product development, and pipeline cost improvements and **shared performance targets and measurement of performance**. If agile is to be achieved, measurement and control, or at the very least monitoring of performance, is necessary.

There are two ways of measurement; one is to measure activities, and the other is to identify and measure processes. A complete supply chain is a process. The very name supply chain indicates the chain as an entity managed as a whole and not as a series of self-centred entities managed independently. The desired end result of the process for a supply chain is to satisfy the customer with the delivery of a perfect order.

Each component in the overall process will have to carry out a set of activities and each component will have a set of measurable standards. These financial, operational and marketing performance measures, although inward looking, if taken with a determination to correct and improve, will lead to an efficient use of resources and will facilitate customer satisfaction. High standards of performance rely to a large extent on demand and supply. Thus, many of the standards and measurements for own performance can without much effort be related to the viewpoint of the immediate supplier and the immediate downstream component of the supply chain. If each component takes a customer centric view, a perfect order will achieve:

**Specification:** Customer specification will be met 100 per cent

**Price:** The price will be better than or at least comparable to the competition

**Time:** Delivery will be in full and on time.

If each component is achieving the delivery of a perfect order, then the process as a whole, i.e. the complete supply chain process, can be said to be performing to customer satisfaction. Bearing in mind each component is a customer of another component, and each component will be getting their desired level of service in the form of a perfect order from upstream. To achieve this desired state, it follows that each component internally will be continuously improving own efficiency in the use of resources.

Chan, and Qi (2003) developed a scoreboard type approach for measurement of the supply chain as a whole with dashboard elements including: Cost, Time, Capacity, Capability, Productivity, and Utilisation.

*Cost – inventory carrying costs.* Inventory management accounts for a mass of total materials handling costs. Effective management should achieve lower costs. Hence, inventory-carrying costs deserve much attention in assessing performance of inventory management. Inventory capital cost, storage space cost, and risk cost are the three key parts of inventory carrying costs.

*Time – flow rate.* Inventory flow rate is based on ratio of the inventory level (in terms of stock units or value) to average inventory cycle time. Flow rate is an indicator of cycle time of inventory within the warehouse. The faster inventory flows through the warehouse, the lower investment on inventory and the improved investment on inventory returns.

*Effectiveness – inventory accuracy.* This concerns inventory record errors when checking stock at regular intervals. Maintaining high inventory accuracy is critical, not only for financial controls, but also for effectiveness of subsequent materials requirement planning and order delivery. Inventory accuracy indicates the effectiveness of both physical inventory management and documentation management.

*Availability – inventory availability.* Availability is one of the most important performances from the customer viewpoint. Inventory availability indicates the customer service level. The two often-used measures are order fill rate (order availability) and stock-out rate (stock unit availability). The former is based on the percentage of demand order filled from stock in total. The latter refers to the rate of stock-outs and the duration of stock-outs.

*Productivity – inventory productivity.* The inventory management process uses a great amount of inputs: labour,

facilities, capital, space and energy. Productivity can be expressed as a ratio of the cost of materials used in production to average inventory level. Other measures include delays in production due to shortage of material.

*Utilisation.* Utilisation of labour, facilities and capital are recognised important resource measures. Inventory utilisation is measured by the percentage of inventory in work to the total inventory held. Storage space utilisation should also be measured. Chan and Qi added that 'metrics are selectively adopted according to the management and measurement emphasis' (p. 187).

The Balanced Score Card also uses a dashboard approach for management. The concept of the Balanced Score Card when introduced by Kaplan and Norton generated considerable interest for senior business managers and led to the next round of development of the scorecard. The focus was shifted from short-term measurement towards generating growth, learning and value added services to customers. Many companies now use versions of the Balanced Score Card as the central organising framework for important decision process and it has evolved into a strategic management system. The four perspectives of the Score Card are usually:

- Financial
- Customer
- Internal processes
- Learning and growth

These indicators are aimed to measure an organisation's progress towards achieving its vision as well as being the long-term drivers for success. Through the Score Card, an organisation monitors both its current performance (e.g. internal processes, finance, customer satisfaction) and its effort to improve and sustain performance (e.g. innovation and employee development). It is also balanced in terms of internal efficiency and external effectiveness. Later, Kaplan and Norton (1996) extended the elements of the overall scorecard to six, these being:

- Return on investment
- Budget
- Shareholder value
- Customer
- People
- Quality



Targets (scores) are formulated for each element, communicated and consensus achieved, executed and results are evaluated with corrective action taken so that the targets (scores) are achieved. Norton says that it is important that all elements are linked and not considered in isolation.

The key performance indicators are generally reported as: **Current actual – Target – Year-to-date actual – Variance to YTD Target.**

When the actual performance value is on or above, then the value is shown as green. If the actual is below the target, but within a given, then the colour becomes amber and red when the value is outside the tolerance limit.

For example:

CUSTOMER PERSPECTIVE				
	Current month actual	Target	Year-to-date actual <i>Four months</i>	Variance to Target <i>Year to date</i>
On-time Delivery	85%	95%	93%	2%

Another area of application is to assess the performance at operation level. Usually the top level indicators are designed in such a way that they can be cascaded to department and section measures to highlight where root cause investigation is needed.

In order to achieve business objectives and a sustainable future, senior managers who are in the driving seats must have a clear view of both the front screen and the rear view mirrors and they must look at them as frequently as possible to decide on their direction and optimum speed. In recent years, the pace of change in technology and the market place dynamics have been so rapid that the traditional methodology of monitoring

actual performance against predetermined budgets set at the beginning of the year may no longer be valid. It is fundamental that businesses are managed based on current conditions and up-to-date assumptions; there is also a vital need to establish an effective communication link, both horizontally across functional divisions and vertically across the management hierarchy, to share common data and decision processes. If an organisation is not in a dominant position in the supply chain, there is little chance that it can influence the performance of the supply chain in its entirety. However, if each member of the supply chain is measuring its own internal activities with the express aim of continuous improvement and is delivering a perfect order to its customers, it follows that the supply chain as a whole will be customer centric. The result being that the entire process of the supply chain will be geared towards delivering perfect orders to the end user. Each player in the supply chain will benefit by being leaner and more profitable. ⏏

**This article is derived from:**

Basu, R and Wright, J Nevan (2008). 'Total Supply Chain Management'. Butterworth and Heinemann. Chapter 19.

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