Managing Corporate Performance
in Technological Industries

Foo Check Teck
Nanyang Technological Institute

Introduction

The purpose of this article is to suggest a model for the analysis of value added performance of companies in the manufacturing sector. This model would relate the primary indicator (or comparator) to national, sectoral and industry-specific value added performances as well as performances of the listed companies. In the real world context, with the emphasis on productivity performance at the national level, the questions that are of current interest to employees will inevitably include the following:

- How did our company perform this year as compared to the previous year?
- Are the other companies performing better than us?
- What are the factors that may have contributed to the results?

With the linking of the general pay increases to corporate productivity performance, answers to the above questions are more than just academic. Hence the need for management to monitor productivity performance, provide timely feedback, and facilitate a proactive managerial style. The condition sine quo non is some understanding by management of the value added approach in corporate productivity analysis.

Beyond Physical Productivity

Although management literature in general stresses that the viability of a company's operations hinges on basics such as competitiveness, innovative-

---

1See for example Report on The Census of Industrial Production, published by Department of Statistics. For listed companies, see for example, 1985 Annual Report of Cycle and Carriage, pp 10 and 11.

ness, adaptability, productivity as measured by value added has emerged as being equally critical. If productivity can be disaggregated into 'production' and 'activities' and used in a relational sense, it would serve as a measure of effectiveness of such activities:

\[
\begin{align*}
\text{[Results of Production]} \\
\text{[Activity]}
\end{align*}
\]

Traditional productivity measures restrict the effectiveness measure to that of efficiency, and thus limit analysis to the production or 'make' phase. Efficiency measures that are commonly used are based on the relation of physical output to physical inputs:

\[
\begin{align*}
\text{[Physical Output]} \\
\text{[Physical Input]}
\end{align*}
\]

or on the relation of actual to established standards:

\[
\begin{align*}
\text{[Actual]} \\
\text{[Standard]}
\end{align*}
\]

Efficiency is only one dimension of how well production activities have been performed. The loop is still incomplete. The products made have to be sold before profits can be realised. The essence of production processes is the enhancement of value (in the eyes of the customers) through the application of combined resources—human, technological and financial. Customers signal this through the price and the quantities purchased. Therefore it makes sense for a firm's system of productivity measurement to capture other dimensions of overall corporate production effectiveness.

**Contextual Factors**

It is unlikely that any model indicative of corporate performance can be universally applicable without some adjustment or refinement. Whilst the attempt here is to describe a model that is deemed to be of general applicability to corporations in the manufacturing sector, it is necessary to have regard to the particular context of each company.\(^3\)

---

\(^3\)The splitting of bought-ins into materials and services (including utilities) is particularly significant in a manufacturing context where the competitive edge lies in efficient materials usage.
To link this indicator to possible explanatory performance factors, the following disaggregated model results: \(^4\)

\[
\frac{V}{En} = \left\{ 1 - \left[ \frac{Bm}{T} + \frac{Bsu}{T} \right] \right\} \times \left\{ \frac{\Theta Q}{A} \times \left[ \frac{At}{En} + \frac{Ab}{En} \right] \right\} \times \{P\}
\]

\(T\) Turnover (or Sales)  
\(V\) Value-added  
\(En\) Number of Employees Employed  
\(Bm\) Bought-in Materials  
\(Bsu\) Bought-in Services and Utilities  
\(\Theta\) Ratio of Quantities Sold to Quantities Manufactured  (assuming no carry-over stocks)  
\(Q\) Quantity of Units Manufactured  
\(A\) Total Assets (or Capital Employed)  
\(At\) Technology-related Capital*  
\(Ab\) Balance of Capital Assets  
\(P\) Mean Price of Product Sold

*"Technology-related Capital" is suggested rather than the more usual 'Fixed Assets'. This will exclude capital assets such as land, buildings and structures.

The primary ratio of interest is value-added per employee which can be dollarised into value-added per dollar employment cost by multiplying the denominator \(En\) by the Mean Employees' Compensation 'Me' and adjusting the right-hand expression by \((Me)^{-1}\). However, the use of value-added per employee has certain advantages as this can be compared to productivity performances at various levels of comparison, as shown below.\(^5\)

<table>
<thead>
<tr>
<th>Level of Comparison</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>Gross Domestic Product per worker</td>
</tr>
<tr>
<td>Industry Major Group</td>
<td>(1) Value-added per worker</td>
</tr>
<tr>
<td>(3 &amp; 5 digit level)</td>
<td>(2) Value-added dollar employees' remuneration</td>
</tr>
<tr>
<td>Listed Companies</td>
<td>(1) Value-added per employee or employment cost or man hour</td>
</tr>
<tr>
<td></td>
<td>(2) Value-added per dollar employment cost</td>
</tr>
<tr>
<td></td>
<td>(3) Value-added per man hour</td>
</tr>
</tbody>
</table>

\(^4\)See Appendix A for derivation and Appendix B for a practical illustration.

\(^5\)Comparisons can also be made with Japanese corporations, the data for which are published by the Japan Productivity Centre in Practical Handbook of Productivity and Labour Statistics.
The contextual diversity of manufacturing companies in Singapore ranges from differences in the degree of variabilities in sale, in markets (both of material supplies and customers), in technology (in the types of production flows ranging from unit to process), in vulnerability to threat of competition, cost sensitivities, financial structures, organisational characteristics such as age, size, labour mix, ownership, to other less obvious aspects (for example, organisational climate) where dissimilarities prevail.

Thus in implementing any generic productivity measurement model as a managerial tool, it is critical to ensure a viable fit of the model to the organisation. Further, unless the model is widely supported by the employees as a representative indicator of productivity performance, the impact of such efforts to vitalise an organisation will be less than optimal. Employees' concept of equity, especially of what constitutes a fair share of the proverbial cake, must also be taken into account. Thus, one necessary prior step must be the training of all employees on the basic underlying concept of value added productivity.

### Parsimonious Manufacturing Model

For the sake of discussion, a typical manufacturing company and its production activities can be parsimoniously represented as a collectivity of resources working in unison in activities which fall under the descriptors of 'buy,' 'make,' 'sell' and 'share.' In undertaking these activities the management has to coordinate the effective performance of different functions. Sub-optimality in one function can lead to dysfunctionality in another. Thus the need for internal goal congruence. Such a parsimonious manufacturing model can be depicted as in Figure 1.

#### Figure 1: Manufacturing Cycle of Value Added Flow

```
   Manufacturing Corporation
       ↓
being a unison of

   Human-Tecnological-Financial
   Resources

   ↓
   Buy  Make  Sell

   Materials
   Services

   Transformation

   ↓
   Product

   Share
```
The key to any effective productivity measurement system is that of effectively signalling to top management regarding areas where possibilities exist for improvement. Appendix C provides a hypothetical illustration of some of the signs by comparing a company's performance against the mean performance of firms in the same industry group or sub-group.

**Relationship of Performance Factors**

Other things being equal, an improvement in one of the performance factors will enhance value-added productivity. Thus all-round improvements in all the performance factors should lead to better overall corporate performance.

At a more in-depth level, the model can also alert management to constraints in attempts to improve productivity from singular approaches. For example, increases in 'A' to 'En' ratio by equipment purchases must also be matched by achievement of a correspondingly higher 'Q to A' ratio (remembering that A = At + Ab given the inter-relatedness of these performance factors). A further provision may be necessary — a constant @. If the reject rate increases perhaps due to poor implementation of new technology, value added productivity will suffer. More generally and simply, to achieve better productivity performance, a total approach is needed.

**Temporal Changes**

Another key to the use of the comparators is that management will be able to judge their performance on a relative basis. Temporal improvements (or declines) can be captured by further refinement in computation, for example by the use of index numbers or relative productivity performance indicators, in relation to corporate value added productivity indicator:

\[
\left( \frac{V}{Ln} \right)_{Co, 88} \quad \text{compared with} \quad \left( \frac{V}{Ln} \right)_{I, 88}
\]

\[
\left( \frac{V}{Ln} \right)_{Co, 87} \quad \left( \frac{V}{Ln} \right)_{I, 87}
\]

I denoting the different levels of comparisons.
Flow of Activities

The model also has a distinct advantage of being sufficiently disaggregated for a manufacturing concern and captures in a meaningful way factors that can be considered vital to factory operations. Each of the indicators captures different dimensions of performance which may impact on the level of value-added productivity achieved. Their sequencing is such as to reflect quite adequately the flow of value creation cycle as shown below.

<table>
<thead>
<tr>
<th>Flow</th>
<th>Indicator</th>
<th>Dimension of Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy</td>
<td>(\frac{Bm}{T})</td>
<td>Effectiveness in attempting to achieve efficiency in material usage</td>
</tr>
<tr>
<td></td>
<td>(\frac{Bsu}{T})</td>
<td>Effectiveness in getting value for money of service efficient utilities usage</td>
</tr>
<tr>
<td>Make</td>
<td>@</td>
<td>Quality of manufacturing process</td>
</tr>
<tr>
<td></td>
<td>(\frac{Q}{A})</td>
<td>Capacity utilisation; operational planning effectiveness</td>
</tr>
<tr>
<td></td>
<td>(\frac{At}{En})</td>
<td>Per employee technological capital intensity</td>
</tr>
<tr>
<td>Sell</td>
<td>(P, @Q)</td>
<td>Mean price and quantity of product sold</td>
</tr>
<tr>
<td>Share</td>
<td>(Me)</td>
<td>Mean employees' compensation</td>
</tr>
</tbody>
</table>

The model thus presents corporate performance in an integrated fashion that different functional executives and other employees can easily relate to and without any de-emphasis on the significance of physical productivity.

Conclusion

The need clearly exists for published data at further levels of disaggregation beyond the five-digit level. Industry associations should seriously consider publishing on a regular basis inter-firm value-added productivity data with controls for such variabilities as product-type, size, technology-type, etc. Comparisons with such controlled groups will be more directly relevant and yield better managerial insights, and a further step towards excellence in management will be facilitated.
To monitor corporate productivity performance by using only measures of efficiency is to limit the productivity focus within the production department, that is the 'make' phase. With highly automated systems of manufacturing now available, the issue is not just efficiency within but also effectiveness without. The successful company, like any organism, will have to constantly adapt itself to the rapidly changing environment.

The organisational responses needed for this must of necessity be multi-hierarchical as well as multi-functional. That is, the production process needs to integrate with sales and marketing, purchasing, personnel, accounting and administration, research and development together, as well as with inputs from the shopfloor right up to the board of directors. To build this 'teamy' approach requires the use of concrete, quantifiable as well as financially meaningful indicators of organisational effectiveness. In particular, what is needed is a primary corporate performance indicator (comparator) that can be related to general performances at the different hierarchical levels and that can in turn be linked to explanatory performance factors. This is represented in Figure II.

**Figure II: Relational Model**

- International *
- National *
- Sector *
- Industry *
- Competitors *

- Primary Corporate Performance Comparator → Key Performance Factors

**Disaggregated Model**

To measure more broadly the effectiveness of the overall activities of the company in value creation effectiveness for the customer, the following basic ratio is suggested as a primary corporate performance comparator:

\[
\frac{\text{Value added}}{\text{Number of Employees}}
\]
Appendix B: Practical Illustration

Assuming the following data relate to Company A manufacturing single product X in year 01:

<table>
<thead>
<tr>
<th></th>
<th>$</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover (T)</td>
<td>30,000,000</td>
<td></td>
</tr>
<tr>
<td>Bought-in Materials (Bm)</td>
<td>12,000,000</td>
<td></td>
</tr>
<tr>
<td>Bought-in Services and Utilities (Bsu)</td>
<td>4,000,000</td>
<td></td>
</tr>
<tr>
<td>Quantities Manufactured (Q)</td>
<td></td>
<td>3,300,000</td>
</tr>
<tr>
<td>Quantities Sold (Qs)</td>
<td></td>
<td>3,000,000</td>
</tr>
<tr>
<td>Total Assets (A)</td>
<td>2,000,000</td>
<td></td>
</tr>
<tr>
<td>Technology-related Assets (At)</td>
<td>1,000,000</td>
<td></td>
</tr>
<tr>
<td>Mean Price of Product X (P)</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Number of Employees (En)</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Mean Employees' Compensation (Me)</td>
<td>12,000</td>
<td></td>
</tr>
</tbody>
</table>

Deriving,

Value-added (V) = T - (Bm + Bsu) = $14,000,000
Ratio of Qs to Q (@) = 0.909
Balance of Assets (Ab) = $1,000,000

Using Primary Corporate Value-added Productivity Indicator as Value-added per Employee:

Corporate Performance for Year 01 is $140,000
References


Singapore Society of Accountants, Recommended Accounting Practice No 3, 1984.


Appendix A: Model Derivation

The corporate indicator disaggregates as follows (using the notations in the text):

$$\frac{V}{En} = \left( \frac{V}{T} \right) \times \left( \frac{T}{En} \right)$$

$$= \left( \frac{V}{T} \right) \times \left( \frac{T}{A} \right) \times \left( \frac{A}{En} \right)$$

Now, $\left( \frac{V}{T} \right)$ can be disaggregated into $(1 - \left[ \frac{Bm}{T} + \frac{Bsu}{T} \right])$

since $V = T - (Bm + Bsu)$;*

$T$ can be disaggregated into $@Q \times P$ and

$A$ can be disaggregated into $Ab + At$.* *

The model becomes:

$$\frac{V}{En} = \{1 - \left[ \frac{Bm}{T} + \frac{Bsu}{T} \right]\} \times \left\{ \frac{@Q}{A} \times \frac{At}{En} + \frac{Ab}{En} \right\} \times \{P\}$$

* As defined in Singapore Society of Accountants, Recommended Accounting Practice No RAP3, 1984, p. 3.

** "Technology-related Capital" is suggested rather than the more usual 'Fixed Assets'. This will exclude capital assets such as land, buildings and structures.
Appendix B: Practical Illustration

Assuming the following data relate to Company A manufacturing single product X in year 01:

<table>
<thead>
<tr>
<th>Turnover (T)</th>
<th>$30,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bought-in Materials (Bm)</td>
<td>$12,000,000</td>
</tr>
<tr>
<td>Bought-in Services and Utilities (Bsu)</td>
<td>$4,000,000</td>
</tr>
<tr>
<td>Quantities Manufactured (Q)</td>
<td>3,300,000</td>
</tr>
<tr>
<td>Quantities Sold (Qs)</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Total Assets (A)</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Technology-related Assets (At)</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Mean Price of Product X (P)</td>
<td>10</td>
</tr>
<tr>
<td>Number of Employees (En)</td>
<td>100</td>
</tr>
<tr>
<td>Mean Employees' Compensation (Me)</td>
<td>$12,000</td>
</tr>
</tbody>
</table>

Deriving,

\[ V = T - (Bm + Bsu) = $14,000,000 \]

Ratio of Qs to Q (\( @ \)) = 0.909
Balance of Assets (Ab) = $1,000,000

Using Primary Corporate Value-added Productivity Indicator as Value-added per Employee:

Corporate Performance for Year 01 is $140,000