Enabling symbolism for communicating performance: strategic analyses of corporate value-added productivity

Foo Check Teck

Introduction

The application of simple mathematical and statistical ideas to present corporate performance is evident most noticeably in published annual reports. Besides accounting which is a discipline by itself to generate the financial results seen in published reports we see the use of charts, graphs and encouragingly the communication of performance through ratios. Although hardly a legal necessity, many publicly listed corporations invest resources to turn the annual report to a professionally designed, colorful brochure accompanied by professional photo shots.

What is surprising, however, is the lack of efforts to convey corporate performance, for example in productivity changes, more directly as well as meaningfully. As this paper shall provide by an illustrative example that this may be done rather simply using currently employed mathematical techniques. The idea is to focus stakeholders and those who work within the corporation too of the changes that may have impacts on productivity performance.

Review of corporate practices

To gain insights into the current modes of conveying corporate performance, five recently published annual reports are reviewed. We see for example gracing the cover of Honda 1997 Annual Report “one of the top-selling vehicles in Japan”. The description of top-selling is another way of saying the factories being able to produce high output that sells. This element of output that is saleable or sells (sales) is implicit in our calculus for reflecting corporate performance. Richly colored photographs of motorcycles are featured in the pages for motor business where productivity and sales are reported. Thus there is reflection of unit sales and net, dollar sales (see Figure 1).

Another interesting example is found in a Hong Kong utility company that supplies power. A color photograph of a new 350MW Lamma Unit 8 adorns the page that contains the chairman’s statement. What is most interesting is in the chairman’s statement (p. 4) reading as follows:

… We are concentrating our initiatives to operate more efficiently, focusing on cutting
Another aspect of our productivity calculus is the emphasis on the annual rate of percentage change and focusing on this year over the last. A typical example is found on the first page of 1995 Hewlett-Packard Annual Report which shows as unaudited the increase by percentage of 1995 over 1994 (see Figure 3). What is most relevant for us are the missing percentages. In particular of improvements in percentage terms of 1995 return on assets over 1994 and similarly of 1995 return on average equity over 1994. Since incremental changes in performance are what management should focus on, we suggest our productivity calculus explicitly accounts for such percentage changes in the key ratios inter-linked together within a given theoretical framework.

The importance of focusing on incremental change emerges too from our review of corporate annual reports in the 1998 Hitachi Zosen (Singapore) Annual Report which at p. 7, though titled as “Five-year financial profile”, read interesting as follows:

During the year under review, the contribution of the subsidiaries and associated companies to the Group’s profit after tax increased by 15 percent from $2.2 million in YE to $2.6 million in YE 98.

One reason for us to focus on year on year change is our belief that what happens last year is likely to remain of far greater significance to management than other years before. In the Hitachi Zosen Report, as though to reinforce the point, the full group structure detailing the various corporate logos of subsidiaries is then displayed. Given these elements that emerge from a review of corporate practices we then discuss our model for capturing corporate performance.

**Corporate performance**

Eilon (1978) gave interesting insights into the analysis of corporate financial performance: of the embedded multi-directionality in the changes of corporate performance. This multi-directionality aspect is further developed here with regard to the analyses of corporate productivity performance. Owing in part to works by strategy scholars such as Porter (1990), there is now a far greater awareness by top management that true competitiveness originate from productivity as measured by value added.
If so the concept of value-added ought to form a core part of corporate communications on performance. What then is value-added? According to Collins English Dictionary (Collins, 1992) the meaning of “value” is unveiled sequentially as follows:

1. importance, usefulness 2. monetary worth [and interestingly] 3. moral principles ...

Indeed these definitions are handy for the purpose of our paper, to illustrate the multifaceted nature of the value concept. As shall be argued later these ordinary meanings of the word value reinforce the role of value-added concept as a part in the system for measuring productivity.

In other words a firm exists to enhance value to society by its presence.

The key to enhancing productivity is in the verb “add”. Although technology[1] plays a major role in the production process of adding value yet the key to being competitive lies in people. The challenge remains of how to motivate people so as to add more value with given resources. This suggests the requirements for a denoting element as part of the analysis.

One simple way is to explain the concept behind value-added productivity is to draw on such ordinary meanings of the term value. Yet to use the concept as a tool to manage productivity and thereby enhancing its growth there is a dire need to quantify the concept. In other words to develop measurable entities based on the concept. Simple explanations of
The literature on productivity measurement tends to focus predominantly on the analytical with scholars generating work mainly on the more refined statistical analyses or use of complex mathematical models. Published papers rarely attempt to integrate mathematical analyses of productivity with aspects of communicating these insights to people are scarce. This is really surprising. For surely, one major contributions from analyzing corporate productivity performance must be to communicate these results to the people so to generate their commitments towards future improvements. Thus the need to spur research that explores these applied aspects of the use of mathematical analyses within industry.

Early management literature such as Barnard (1938, p. 91) has argued for the importance of communications in organizations:

> communication would occupy a central place…

Katz and Kahn (1978, p. 428) continued to emphasize the centrality of communications in organizations:

> … the exchange of information and the transmission of meanings is the very essence of … an organisation …

It is communicating organizational meanings rather than just mere communications that is the key to effectiveness. As Hall (1987, p. 196) aptly put it:

> … More and more accurate communications do not lead inevitably to greater effectiveness for the organization …

Also, there is growing realisation among management scholars of the ambiguity that surrounds the processes in organizations (e.g. March and Olsen, 1976):

> … the simple machine model of organizations is increasingly being questioned.

Some scholars argue that symbolism is deeply embedded within organizations (Turner, 1999a, b). In the strategic management field, there are indications of growing interest too towards the management of meaning or metaphor within organizations (Gahmberg, 1990; Greiner 1983).

**Rational symbolism**

In this paper a generic, rationally symbolic process for communicating results from analyses through the application of
mathematical identities is then presented. One that incorporates some of the elements identified in a review of corporate practices in reporting performance in annual reports. For simplicity the methodology assumes a single-product firm. Such a model may however be extended to multi-product situations[2]. Insights gained from mathematical analyses in the directional changes in corporate productivity performance are conveyed through use of rectangular, “loaf of bread”-like diagrams.

One reason for the choice of “bread” as an analytical symbol is that workers on shop floor especially in the West have for long equated “loaf of bread” as part of one's livelihood. Thus an enlarged “loaf of bread” may symbolise to workers growth in productivity measured by value-added. There is more “bread” now to be shared among those within the firm. Their increasing sizes are symbolic of enhanced productivity change. Correspondingly, their reduction speaks of diminution in productivity growth. If workers are Japanese then a more appropriate symbol may be to use a rectangular, lacquered container often used to hold cakes of rice for lunch.

A “one primary and three disaggregated ratios” approach in building mathematical identity model is advocated. Such an identity is seen as integral part to a hierarchical framework of ratios for analysing corporate productivity performance. A practical, numerical example is provided for illustration. Spatial, geometric “bread” or wooden “rice-container” portraits of the results of mathematical analyses are then presented and explained.

**Explaining strategic variables**

Our primary variable of interest lay in per employee measure of value-added. The focus on communicating performance using a per employee measure is logical as improvements in organizations are via people. That is perhaps one reason why Hong Kong Telecom uses this per employee measure so extensively as in operating profit per employee, turnover per employee, exchange lines per employee and benchmarking against other international telecommunications companies (see Figure 4).

Additionally, arguments on why value-added per employee (va/e) reflecting people productivity is a useful primary measure of corporate productivity performance are set out in Foo (1989, 1990, 1992, 1993, n.d.). Here the purpose is to simply illustrate how such a concept may be explained to people at work.

Earlier definitions in the Collins dictionary (1992) may be utilized here. Thus the broad concepts of a firm being of value to society may be emphasized. That is to be of “importance” or of the firm rendering some “usefulness” to society. This is not simply a lofty strategy. For the giant firm of Mashushita is well known to have emphasized such broad societal values to their employees. Thus broader connotations may be brought to bear through a style of management emphasizing this other symbolic meaning to “value”.

For example, in introducing the concept of value-added people at work the manager of the shop floor may begin with statements such as follows: “Our firm seek to be of value to society. As such we must strive by our daily production activities to be adding value. To capture our capabilities in so adding value, we use value-added as a measure of our firm performance”. Here, there is a subtle transition in the shade of meaning to value. In other words to draw upon the second monetary meaning to the word of value. We therefore tap into the cascade of meanings to value. Then assuming some educational attainments on the part of the people at work, the manager may then proceed to explain how this may be mathematically be formulated. In other words of applying simple mathematics in the business of managing the firm.

What follows is merely suggestive:

“Now how does one then measure value-added?”

Such a question acts as a trigger to set off the thinking process by people at work.

“One approach is to determine the value that is added to raw materials we buy-in. Thus, we look to the difference between the sales price for a product and then deduct the cost of essential raw materials. For example, for an expensive piece of rosewood furniture to less off from the sales price the cost of hardwood. A high differential reflects our ability to transform hardwood – that any body may buy – to final product say, a chair that is
Figure 4

How do we compare?
Hong Kong Telecom compares very well when benchmarked against other international telecommunications companies — one of the reasons we are considered to be among the best in our industry.

Note: This Figure is reproduced from the best original supplied
Source: Hong Kong Telecom (1997, pp. 27-31)

highly prized by our customers. That is one measure of our productive capability."

I have in my lecture taken this approach to explain the value-adding concept. I take a blank sheet of paper and ask rhetorically: "How much is it worth?" Sometimes an answer is volunteered as "Five cents". Then I do by a quick scrawl a picture onto the paper and then ask "What now?" while there are a range of responses they inevitably suggest it is now a waste paper and thus valueless. Now the pen is the writing technology, the paper the raw material and my hand the "know-how". Often I then probe them further "What if the late Picasso had drawn this instead?" Again invariably there will be a spread of replies but all pointing to the paper now becoming a piece of fine art one that may even run into millions of dollars in value.

There is some difficulty, however, with using the denominator, number of employees. Here is where, in technical papers, we list down our assumptions. For example in drawing insights when comparing value added per employee across firms. But people at work however being down-to-earth and practical tend to shy away from assumptions. Such assumptions tend also to somewhat negative in the minds of people in workplaces the utility of value-added as a practical measure of performance. Briefly, one approach to handle this part of the explanation is to use rather simple analogy. For example, the comparison between boats of people fishing by hook, out on fishing trips. Invariably, it ends up in discussion of how many fish have you caught per person. The measure becomes simply:

Number of fish/people.

The complexity may then be introduced, such as differences between boats in terms of the number of rods being cast. One person may, in some cases, cast more than one rod. When it comes to this it is then an opportune time to bring in these ratios with the ultimate purpose of later integrating them as follows:

Number of fish/number of rods.
Number of rods/people.

Now the number of rods may be drawn as being analogous to tools and machinery and thus of the technology employed in the process of manufacturing. One may then
easily explain that even in these simple counts assumptions are being made. These rods are roughly the same. For each person is likely to bring his/her own fishing rod. Since most people like to have a fruitful outcome we may reasonably assume the use of effective rods. Thus, these tend to be of the rod and reel variety rather than just line and rod.

For the sake of pure comparative accuracy one must define the counts to include only those using the same kinds of rods. There is, however, a wide range in the fishing gear, even if we limit our counts to rods with reels. In so doing one may end up becoming trapped by paralysis through analysis. The basic purpose of developing such measures of performance is really to stimulate a healthy competitive spirit rather than to become exact as in science. Equally effective for gaining a sense of having made progress is to chart the progress made by those in the same boat fishing over time, say by comparing the number of fish that are caught per person across two of these periods of this, versus the last.

For analytical purposes it may be explained to people at work that this primary ratio in the number of fish/people may be meaningfully extended. Why? So we may gain insights as to performance at fishing. One such possibility that bears a close analogy with work context, example a machining shop floor is explored here as follows:

Number of fish/people

\[ \text{Value added/people} = \text{Value added/technology} \times \text{technology/people} \]

Thus a higher number of fishes caught this time when compared to the last may be accounted for by a greater availability or more intense use of rods per person. What is important is to realize that this is but one plausible explanation. Many other factors may be at work too. Here too it is timely to raise the assumption that this may indeed be true if “all things remaining equal”. But this rarely happens.

What then ought to drive these analyses?

An innate human tendency to want to improve. That is the key. In other words, as human beings are curious to know if when they go fishing if they are making good improvements. There thus is a role of such simple mathematical analyses. To satisfy such human needs to know their progress. For such a feedback often act as powerful motivator to perform even better. This may be one reason why benchmarking has become so popular as a management tool. Enhanced competitiveness thereby reinforcing greater interest by firms on how one is performing. As the first time a firm should strive to improve in performance over time. To begin with a firm should focus on differences in performance of the now versus the last period.

We turn to the workplace.

**Performance variables at workplace**

The simple analogy to a manufacturing workplace is as follows:

Value added/people

\[ \times (\text{number of rods/people}) \]

Here it is useful to explain to people at work that while “technology” employed may easily be operationalized as in the fishing trip example as counts in the number fishing rods it is conceptually far wider. For it embodies that which is difficult to count in a simple manner the knowledge and skills of those who wield the rods.

Another approach to extending the ratio of value added/people may be more appealing. One which that involves a measurement of “sales”. Conceptually there ought to be little difficulty in telling people at work why it is crucial to factor at an early stage this strategic variable. Indeed the measure of value-added as described involved sales. That is value-added = sales – cost of the raw materials and in earlier example, hardwood. Thus value-added/sales reflect in a simple way how highly value-added a firm is. The other ratio of appeal is sales/people for it captures almost immediately (number of fish per person) a key performance indicator.

Putting these three ratios together one get a mathematical identity:

Value added/People

\[ = \text{Value added/Sales} \times \text{Sales/People} \]

This process of putting down a primary ratio value added/people and then to bring in independently two others of value added/sales and sales/people differs from presenting these as a disaggregation. For these two ratios (value added/sales and sales/people) are put
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together like the piecing together of two pieces of a puzzle that forms the overall picture of value added/people. The analogy of a puzzle is of instructional value. For it metaphorically suggests the sources of say an increase of productivity (value added/people) over the last period. In other words which of the two has grown incrementally more in the period so as to contribute to the final bigger "picture".

Perhaps at this point it may also be appropriate to introduce the mathematical step of disaggregating the last ratio, sales/people. For the next step in extending the ratios is easily grasped by people at work. It is something that confronts people at work almost daily: prices. Thus sales may be disaggregated into two major components: mean price × quantities sold. Thus the last ratio thus becomes mean price multiplied by the quantities sold over people. The mean price is thus one more piece of the puzzle to explain the big picture of corporate performance in productivity of value added/people. Such expressed quantification allows for quantifiable attribution of the falling product prices to declining productivity.

How necessary is this further step? In the highly competitive world of electronics falling prices is becoming the trend: you pay less and get more. Another, in a crisis-ridden world, is the specter of collapsing prices due to crumbling exchange rates, this is a reality. The idea to factor price in the analysis is to present these harsh facts to people at work and thus they are better able to "see" how necessary it is to be competitive.

Disaggregation, as part of the analysis, is shown below:

Assume single product company, c.u. currency units, va = 10,000,000c.u., e = 100 persons, sales = 20,000,000c.u., price = 1,000c.u. each, quantity = 20,000 units; va/e = 100,000c.u., va/sales = 0.5, price = 1,000c.u., Qs/e = 200 units, va/e = va/sales × price × Qs/e, va/e increases by 9 percent or 109,000c.u.

To summarize, these are the ratios selected as part of our productivity calculus strategy for improving corporate performance: value added contribution (value added/sales; va/sales), pricing (mean "price" obtained), output per person (quantity manufactured and sold/people; Qs/e). Also each of these disaggregated ratios capture a different dimension of corporate performance.

Value added contribution as seen in value added to sales (va/sales) measure the proportionate contribution of value added per currency unit of sales (whether dollar or pound). Sharp changes in these ratios are obtained when corporations for strategic reasons, decide to sub-contract or diversify away from the more labour intensive but less value adding operations. For instance, a corporation may devote more of their internal resources to product design, research and development while shifting their production activities to the less-developed countries.

Also, the value added to sales ratio reflects the relative capabilities of corporations in value transformation with the available resources including new technologies. Pricing is yet another strategic variable that is surprisingly, inadequately emphasized in the productivity improvement literature. In contrast, physical output per person or efficiency (Qs/e) is often regarded as being synonymous with productivity per se.

There are several reasons why these variables – value added contribution, pricing and efficiency – should be emphasized in improving people value added productivity at the corporate, strategic level.

First, there is a need to emphasize an integrated, multi-stakeholder approach in corporate efforts to improve people productivity. A broader conceptualisation of people involvement for malting improvements is needed. The concept of people should be sufficiently broad to encompass corporate stakeholders: the board of directors, shareholders, employees, customers, sub-contractors, and even lenders. Even though for analytical purposes, only those persons in corporate payroll are entered in the denominator, "e". It should be remembered that the number of employees enters the mathematical analyses as a proxy for input factor – there is the implicit assumption of a constant mix of the factor inputs (especially between capital and labour).

Second, the analytical approach should foster a multi-functional interest in improving productivity performance. Productivity improvement should be the concern of every individual in the organization. This will be stimulated by the analysis of different
dimensions of corporate productivity performance. For instance, the inclusion of pricing as a dimension of analysis should interest those in the marketing function. Similarly, staff in the production department will be keen to learn of physical productivity performance (Qs/c). In deriving a hierarchical system of ratios, top management should try to incorporate as wide an array of dimensions as it is logically possible.

Hierarchical system of ratio analyses

As argued in this paper, it is critically important to integrate both the analytical as well as the presentational aspects in analysis of corporate performance. We incorporate both in our productivity calculus. There are limits however to the number of dimensions that may be portrayed at any one time. As a consequence the analyst is limited to a choice of three variables given any one primary ratio of interest. However the productivity calculus may be augmented through a hierarchical system of ratios. In the process, the explanatory variable is treated as a primary ratio of interest. Thus, taking the example of the concept of value added contribution (operationally as value added/sales).

\[\text{Value added/sales} = \frac{\text{value added/technology} \times \text{technology}}{\text{investment} \times \text{investment sales}}.\]

Value added contribution as seen in value added to sales can be further disaggregated into ratios that reflect, yet again, different dimensions of corporate performance. As indicated, these are productivity payoffs from the investments made in technology (value added/technology), the share of corporate investments that are in technology (captured proportionately by technology/investment) and the relative size of capital investment given the available resources as reflected in corporate sales.

The other concept embedded in corporate productivity analysis is efficiency of operations (output/number employed). Again, a set of three ratios (output/capacity, capacity/investment and investment/number employed) may be suggested for a more in-depth analysis of corporate performance in this dimension.

Output/number employed

\[= \frac{\text{output/capacity} \times \text{capacity/total assets}}{\text{total assets/number employed}}.\]

Capacity utilisation is measured through the output achieved relative to the available capacity. The second disaggregated ratio captures the capacity available given the capitalisation of the company. The last ratio reflects broadly the relative capital intensity of the company.

These are two examples of how a hierarchical system of ratios may be developed given the root identity (va/e = va/sales × price × Qs/c). Further extensions are possible but is outside the scope of this article whose purpose is develop on symbolism in productivity measurement and analysis. In the next section, a numerically-grounded example is given to illustrate the approach suggested here.

An illustration

To illustrate the analysis of corporate productivity performance, a simple hypothetical company is utilised. It is assumed in this discussion that the company manufactures a single product with perfect quality control – zero defect – and all the output is sold. The annual sales for the company in year 01 is assumed to be 10,000,000 currency units (c.u.); total output being 20,000 units; where the mean price obtained is 1,000 c.u.u. per unit and 100 persons are employed. Given these data, the year 01 productivity statistics are as follows.

Value added contribution (value added/sales) is 0.5, value added per person is 100,000c.u. and physical productivity or output per person is 200 units. Assuming that people productivity (va/e) in year 02 improves by 9 percent or is now 109,000c.u.

Following Eilon (1975, 1978, 1992), it is posited that in corporate performance analysis, the directions of change in improvements are as equally important as the extent. The primary variable of concern is in people productivity (operationallised as value added per employed person; va/e). Improvements in this ratio is then explained in terms of the changes in value added contribution, pricing and physical productivity. This is formalised below:
Value added/people = value added/sales × pricing × quantity/people

Denoting value added/people, value added/sales, pricing and quantity/people by \( \Omega \), \( \alpha \), \( \beta \) and \( \theta \), the expression of the simple mathematical identity using Greek notations becomes as follows:

\[
\Omega = \alpha \beta \theta
\]

(2)

Now, if \( \Omega \), \( \alpha \), \( \beta \) and \( \theta \) change in one period to \( (\Omega + d\Omega) \), \( (\alpha + d\alpha) \), \( (\beta + d\beta) \), and \( (\theta + d\theta) \) respectively, then (2) becomes:

\[
(\Omega + d\Omega) = (\alpha - d\alpha)(\beta + d\beta)(\theta + d\theta).
\]

(3)

Multiplying, the right hand side becomes:

\[
d\alpha \beta \theta + d\beta \alpha \theta + d\alpha \beta \theta + d\alpha d\beta \theta
\]

Dividing both sides by (2) and representing the incremental changes by the asterisks \( (d\Omega/\Omega, d\alpha/\alpha, d\beta/\beta \text{ and } d\theta/\theta \text{ respectively}) \), the following model of incremental change calculus is obtained:

\[
\Omega^* = \alpha^* \beta^* \theta^* + \alpha^* \beta \theta^* + \alpha^* \beta \theta^* + \alpha^* \beta \theta^*
\]

(4)

The model reflects one period change in primary ratio \( (\Omega^*) \) value added/people) in terms of changes in the other variables of value added contribution (\( \alpha^* \)), value added/sales, mean price (\( \beta^* \)) and physical productivity (\( \theta^* \)), quantity manufactured and sold/people and also the interactions between these variables (\( \alpha^* \beta^* \), \( \alpha^* \beta \theta^* \) and \( \alpha^* \beta \theta^* \)). For the time being, let it be assumed that the value of the interaction terms are so small as to be negligible.

These interaction terms will however be incorporated in the analysis in subsequent discussion. It may then be said that the one period change in the primary ratio of interest can be approximated by changes in the variable on the other side of the mathematical identity:

\[
\Omega^* = \alpha^* + \beta^* + \theta^*
\]

(5)

Improvements in people productivity \( (\Omega^*) \) may be a consequence of any one of the seven possible outcomes indicated in Table I.

Column I shows people productivity (value added/people) to be due to improvements \( (+) \) in all the explanatory variables: value added contribution \( (+) \) (\( \alpha^* \), value added/sales), pricing \( (+) \) (\( \beta^* \), mean price) and physical productivity \( (+) \) (\( \theta^* \), quantity/sale/people).

Columns 2, 3, and 5 show improvements in two of the three variables (i.e. \( 2^* + \* \text{ and } 1^* \text{ - } \* \)); columns 4, 6 and 7, there is improvement in only one of the variables (only \( 1^* + \* \text{ but } 2^* \text{ - } \* \)). Since value added/people is assumed to be positive, the improvement in one singular ratio (columns 4, 6 and 7) must be sufficiently large to offset the declines in the other two ratios.

Table II shows these possibilities within the seven scenarios framework. Thus in Scenario 1, if all the variables improve by about 3 percent each, then given the formulation of the model in (1), improvement in the primary ratio of people productivity may be said to be "contributed" by these improvements. In scenarios 2, 3 and 5, the extent of the combined improvements in any two of the variables must be such that they still yield a net 9 percent after offsetting the declines in the remaining variable. As for scenarios 4, 6 and 7, the improvements in one of the variable must necessarily be substantial so as to offset the declines in the remaining two variables.

Table III provides the computational details when the interaction terms are considered in the corporate productivity analysis. As can be seen, for the case cited, interaction terms may for practical purposes be deemed to be negligible. Indeed, Hilson (1975, 1978, 1992) had suggested that in general where the percentage in the primary ratio is less than 10 percent, interaction terms can be ignored. For most companies, the annual productivity

<table>
<thead>
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<th>Table I Seven productivity scenarios</th>
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<tr>
<td><strong>Productivity indicators</strong></td>
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<tr>
<td>Value added/people</td>
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<td>+ + + + + + +</td>
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<td>Value-added/sales</td>
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<td>Pricing</td>
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<td>Quantity/sale/people</td>
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Table III

<table>
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<tr>
<th>Scenario</th>
<th>Va/sales (%)</th>
<th>Pricing (%)</th>
<th>Q/sale (%)</th>
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<tbody>
<tr>
<td>Scenario 1</td>
<td>3</td>
<td>3</td>
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<td>Scenario 2</td>
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<tr>
<td>Scenario 3</td>
<td>3</td>
<td>9</td>
<td>3</td>
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<tr>
<td>Scenario 4</td>
<td>-3</td>
<td>15</td>
<td>-3</td>
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<tr>
<td>Scenario 5</td>
<td>-3</td>
<td>-3</td>
<td>9</td>
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<tr>
<td>Scenario 6</td>
<td>-3</td>
<td>-3</td>
<td>15</td>
</tr>
<tr>
<td>Scenario 7</td>
<td>15</td>
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<td>-3</td>
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</tbody>
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improvements are unlikely to exceed more than 10 percent. Although refined analysis such as the use of incremental calculus may be mathematically elegant, one of the main purposes in analysing corporate performance should be the effective communication of the analyses to employees, especially those at the shopfloor. The next section suggests an approach for communicating the results of such analysis through simple geometry.

**Spatial, geometric portrait of productivity change**

As shown in Figure 5, three different axes can be used to reflect the dimensions of interest in productivity change analysis. The axes may represent the value added contribution, pricing and efficiency. These are represented by the values of “a”, “b” and “c”. The primary ratio of interest is reflected as a spatial point “P” (since $P = a \times b \times c$). One advantage of using 3D representations as productivity is subconsciousness the association by employees of productivity as the size of output (relative to input) and depending on one’s culture as “bread” or wooden “rice bowl”. These insights I draw too from my own observations when conducting productivity improvement courses held under the aegis of the National Productivity Board, Singapore. If such cubes are used to compare the productivity performances of two companies A and B in year 01, the company with the larger sized cube will convey an immediate symbolic meaning as being more productive.

The other advantage, though far less persuasive, lies in the use of such cubes to portray accurately improvements in productivity. Figure 6 shows the one period change in productivity geometrically.

**Figure 6**
Assuming in period \( t + 1 \), incremental improvements are made in value added contribution ("a"), pricing ("b") and physical productivity ("c") so that new values of "a + da", "b + db" and "c + dc" are obtained. The interaction effects are also portrayed. If drawn proportionately, the incremental spaces provide visual, informative summaries of the relativities of the improvements made in year one. This contrasts with the use of mathematical identities where the analyst will be confounded with the vexing task of explaining the meaning of interaction terms. Also, since employees at the shopfloor have lower level of education, they are less likely to find analyses of productivity performance through the use of mathematical identities as appealing as simple graphics.

Spatial representation is also useful in the comparative analyses of productivity performances (see Figure 7). Let us assume that the corporate productivity of C, C' and C" (being competitors in the same industry) are equal, such that \( p = p' = p'' \) (note the superscripts) but there are however differences in the different dimensions of performance reflected by value added contribution (\( a, a' \) and \( a'' \)), pricing (\( b, b' \) and \( b'' \)) as well as in physical productivity (\( c, c' \) and \( c'' \)). If this is the case, then the spatial, geometric representations of productivity performance will vary accordingly as well. The different configurations if presented, visually are likely to have more immediate symbolic appeal to employees than use of statistical data. Although corporation C's productivity level of \( p \) equals that of C' (\( p' \)) and C" (\( p'' \)), the performance in C is superior mainly in terms of value added contribution (\( a \)). Also, the performance of C, in comparison with C' and C" is the weakest in physical productivity (\( c \)). A similar approach can be applied in analysing the productivity performance of corporations C', and C".

The use of spatial, geometric representation is particularly useful in reflecting the different possible directions of change in productivity improvements. Earlier discussion has shown that assuming that these three variables of

\[
\begin{align*}
p &= a \times b \times c \\
p' &= a' \times b' \times c' \\
p'' &= a'' \times b'' \times c''
\end{align*}
\]

\[
\begin{align*}
a &> a' > a'' \\
b &> b' > b'' \\
c' &> c'' > c
\end{align*}
\]
value added contribution, pricing and efficiency are of strategic importance for understanding improvement in people productivity, then there seven possible scenarios. Figure 8 shows the different seven scenarios that correspond to Table III.

"Bread" as symbols of corporate performance

In developing productivity measurement system in organizations, management should also consider the communication aspects – and to use the Internet for enhancing strategic analyses, as in the directional changes of corporate value-added performances. In building up a corporate productivity measurement system, organizations should also incorporate symbolic elements as part of its system design. There is growing awareness of the relevance of the work of organizational symbolists in understanding organizational phenomena. "Bread" or Japanese "wooden rice-box" or any visual form may be utilized to conveying meanings symbolically in interpreting changes in organizational performances (Smircich and Morgan, 1982). In the example given, the goal is to help foster shared meanings – at the symbolic level – and of the directions towards which improvements in productivity ought to be made (Smircich, 1983). Finally, in designing such systems, consideration should be of the cultural dimensions (Foo, 1992). The western mind may be more akin to the direct, rational-analytic approaches in communications while the Eastern and particularly the Chinese and Japanese may be more inclined to the pictorial and symbolic.

Figure 8

Note: This Figure is reproduced from the best original supplied
Enabling symbolism for communicating performance

Fook Chek Teck

Note

1 Technology is conceptualized as plant, machinery and know-how required to transform raw materials into finished products. Know-how constitutes the body of proprietary techniques utilized as part of the production process. Subject of another paper in progress.

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