



# **Do we practise quality principles in the performance measurement of critical success factors?**

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**Abstract** *During the 1980s, many companies introduced management and production control initiatives, such as total quality management, self-directed work teams, just-in-time, manufacturing resource planning, flexible manufacturing systems, etc. All too frequently, operational improvements attributed to these initiatives are not reflected by similar financial improvements. This paper outlines some probable reasons for this apparent incongruency of outcomes. A non-quality approach to performance measurement is identified as a major contributor to this lack of financial improvement. A generic model for linking performance measures that achieve the strategic objectives of an organization is presented. A methodology is proposed to identify critical success factors, and for the set-up and implementation of a performance measurement system. A number of key issues related to the application of available information for decision-making processes are also identified. A strategic and integrated approach to the measurement of manufacturing organizations is outlined, which, if adopted, should result in management initiatives being optimized, and organizations improving their competitive position and profitability.*

## **Introduction**

The manufacturing industry is undergoing a period of major change. Management information systems, with high levels of sophistication, are now available to small and medium-sized organizations at costs that are in many cases less than the cost of a family motor car. New production and control systems are being introduced into organizations at an ever-increasing rate. Firms recognize that customer service, product quality, organizational efficiency, cycle times, product innovation, flexibility, etc. are critical for their future viability and survival. Key objectives for improved organizational performance, while relying on financial measurement, are beginning to take into account business and organizational performance measures. Orienting performance measurement systems towards traditional financial and cost management measures has had disastrous consequences for the long-term efficiency and profitability of a firm, since the focus is to reduce the cost of 'inputs' rather than maximize the quality and volume of 'throughput'. Traditional financial measures act as barriers to the achievement of increased stockholder value, higher quality, lower cost and speed to market because they give false signals as to the actual position of the corporation's performance. As Gregory (1993) points out, at best traditional measures provide little

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information to operational levels, and at worst they encourage behaviour detrimental to company interests. Current examples are: the use of expanded inventories to minimize volume variances recorded by cost accounting systems; the use of contract labour to reduce fixed staff costs; the use of outside vendors; and the selection of lowest-price suppliers, irrespective of quality or on-time delivery capacity. A number of studies and surveys of world manufacturing enterprises have highlighted this dilemma, and reflect the trend of leading firms towards competing on a wider range of key success factors other than price/cost leadership as their top priority (Business International Corp., 1990; Harrison, 1990). With a focus on customer responsiveness, profitability, quality, innovation and flexibility of product choice, companies are employing a mix of performance measures and balancing or trading off between respective functional area requirements. Kaplan and Norton (1992) refer to this process as the 'balanced scorecard' approach for selecting key performance indicators of corporate performance. Managers are realizing that in order to achieve the strategic objectives of the organization, it is essential that a culture exists that is conducive to the continuous improvement of organizational processes in all functional areas, and to transform the business inputs into outputs that are supplied to the customer. Many companies are able to achieve major improvements in operational areas, yet these improvements are not reflected in their financial statements, or in internal management and cost accounting reports. In fact, it is not unusual for situations to exist where major operational improvements are achieved, yet traditional reporting figures show the reverse. Goldratt and Cox (1986) demonstrate this very clearly in *The Goal*, where they emphasize how the optimization of one section results in sub-optimization of the firm as a whole. This is a common problem in the manufacturing industries.

Many organizations are endeavouring to introduce some form of total quality management (TQM) into their operations. It would appear, however, that in the vast majority of cases, the cost and management accounting areas are ignored when it comes to supplying a service that meets their customer requirements; that is, timely, useful and accurate information. Instead of an integrated approach to operational performance measurement, what is more often found is a measurement system confined to functional 'silos' where information exchange is localized. At best this is inadequate, and at worst misleading, giving incorrect signals that frequently result in poor strategic decisions relating to market potential and business capability. The use of these local performance measures results in the optimization of a local area, frequently resulting in considerable sub-optimization of the total organization. There is also a high probability of the 'fudging' of data in order to meet these local measures (Fry & Cox, 1989).

During the 1980s, many companies made enormous efforts to improve their operational systems with the introduction of TQM, just-in-time (JIT), manufacturing resource planning (MRPII), and flexible manufacturing systems (FMS). However, these companies had not matched their adoption of such operational strategies with a corresponding review of their financial and management accounting systems. Industry in general has been extremely slow in adapting its accounting systems to the current requirements of firms that are intent on becoming world competitive manufacturers (Kaplan, 1990, p. 1).

Recent moves to improve business performance have employed activity-based management and its associated activity-based accounting systems, in order to assign costs more directly to activities that contribute to improvements in overall business processes (Brimson, 1991; Cooper *et al.*, 1992; O'Guin, 1991). Even the use of an activity-based accounting system may fail to achieve its potential if the data generated are not used to support a theory of constraints (TOC) management process (Spoede *et al.*, 1994). The TOC management process, with its priority to increase throughput, is critical if continuous improvement is to be

reflected in financial statements (Goldratt, 1990a; Lockamy & Cox, 1994). This management perspective stretches across departments and functions, and highlights opportunities for true cost reductions. It is important to remember, however, that reduction in expenditure must still be aimed at improving organizational performance such as cycle time, response time, quality levels, productivity, delivery capability, etc. It must also be recognized that if improvements do not result in increases in throughput, they cannot be regarded as improvements, only operational changes. In order to achieve this, an integrated and holistic view of performance measurement must be taken which will provide a framework for evaluating the effectiveness of a firm's continuous improvement cycle regarding initiatives for employee development, and capital and technology investments.

### Financial or non-financial measures

Common complaints are voiced by production and manufacturing managers about their performance measures being traditional cost management or financial, instead of measures that will indicate operational improvement. 'Get rid of these old fashioned financial measures' is frequently the cry. This complaint in many cases is quite legitimate. We are still using cost management systems developed in the early 1900s, but in many cases production and control systems developed through the 1980s. The case of costing by output rather than capacity of a localized work centre is a good example of wrong signals being transmitted to management (Kaplan, 1990, p. 19). A typical example would be a work centre producing 100 000 units at a cost of \$100 000, with the traditional output cost accounting calculating the unit cost as \$1.00. If an operational manager introduces a programme of continuous improvement, the objective would be to improve items such as set-up times, reduce scrap and rework, improve on-time performance, etc. All these objectives are congruent with the strategic objectives of a firm intent on achieving a world competitive position, or just improving its current position. However, if for some reason beyond the control of this work centre, production should drop to a level of 80 000 units, e.g. through a lower demand for the product or a change of product mix, any improvements made would not be reflected in the management accounting reports. In fact, quite the contrary will occur: an increase in product cost of \$0.25 will be reported, rising to \$1.25 per unit. If during the same reporting period the improvements of the work centre were such that the capacity had increased by 50% with no increase in costs, apart from this not being documented, regressive decisions may be made on the basis of this increased product cost. For example, a decision to retrench staff may result. This would not affect the production capacity, as the work centre has an increased capacity, but it would make it extremely difficult to introduce further improvements if people believed that achieving improvements results in job losses.

If, however, the measure was 'cost of work centre' divided by the 'capacity of work centre', the unit cost would be \$0.66, not \$1.25, and the excess capacity would be properly recorded. This could be directed into other production, other products or a price decrease in current products to help to increase sales and penetrate new markets, or improve the functionality of the current product for the same price. However, it still might result in retrenchments if no other use could be found for the excess capacity. The point is that any top management decision based on traditional measures would not reflect the true cost of production. In the latter case, at least retrenchments would be a last resort, as the information supplied would enable management to examine a number of different options, before reducing labour.

This example, however, does apply when adopting either an output- or capacity-based approach, if the improvement in the work centre does not result in an increase in the

throughput of the business. In these cases, a localized measurement will be of little use where other constraints exist that prevent throughput increases. There is no improvement, only a change, and as Goldratt (1990a, p. 10) notes, “Not every change is an improvement but certainly every improvement is a change”. Constraints may be related to other work centres in the manufacturing process, or exist in other functional areas such as sales, distribution or marketing.

To overcome this narrow focus requires a change of paradigm from a cost minimization and cost plus selling price approach, to a throughput maximization and market pricing approach.

### **Theory of constraints and performance measurement**

If the goal of the organization is to maximize profit, then this objective is best achieved by maximizing throughput at minimum cost. In order to maximize throughput, a TOC management approach must be adopted applying the following five steps to all improvement initiatives (Goldratt, 1990a, pp. 5–7).

- (1) Identify the system’s constraints.
- (2) Decide how to exploit the system’s constraints.
- (3) Subordinate everything else to the above decision.
- (4) Elevate the system’s constraints.
- (5) If in the previous steps a constraint has been broken, go back to step 1, but do not allow inertia to cause a system constraint.

Under a TOC approach, ‘throughput’ reflects all monies generated by the business; that is, total revenues received, less monies paid to vendors, e.g. raw materials, outside contractors. Net profit before tax is throughput minus operating expenses. An organization that concentrates on increasing throughput while reducing or holding constant operating expenses and inventory will have these improvements reflected in its financial statements. This requires a change in thinking. Financial statements currently treat inventory as an asset, while the aim of modern management practice is to reduce inventory, since high work progress (WIP) and finished goods inventories are seen as costly liabilities. Localized performance measures such as a ‘target production level’ are conducive to increasing finished goods inventory but ignores the global effect of high inventory levels. The short-term effect of this will be an increase in the ‘asset’ inventory, which ultimately results in an increased net profit being reported in the financial statements. This finished goods inventory may well have to be disposed of at a lower return than its recorded value because of obsolescence or changed economic conditions. The actual loss, however, will most likely be recorded in a different accounting period, and not directly attributed to the fact that it should never have been produced in the first place if a ‘throughput’ philosophy based on TOC had been adopted. It is important that a constraint is recognized as anything that prevents the maximization of throughput. This does not have to be a physical constraint, such as work centre capacity, or limited distribution resources: it could be a market constraint. Goldratt (1990b, pp. 64–78) exemplifies the difference between a traditional cost accounting approach to production using localized performance measures and a TOC throughput approach. He stresses that an understanding of when production becomes throughput is an essential key to applying these strategies successfully. In some cases, it will be necessary to subordinate (step 3 of TOC) to a market demand constraint, as the best production mix may not be accepted by the market-place. Exploring this possibility highlights the importance of taking an integrated approach to key performance indicators that meets global goals and is truly cross-functional. There is little to be gained by marketing

departments making decisions and using local KPIs without close collaboration with production, distribution, finance, etc., and vice versa. Another issue that is frequently neglected is what data are available in the information system and the quality of the data. Information systems need to be designed to support these new management practices, which again require a change in traditional thinking (Goldratt, 1990b).

A major criticism of traditional accounting is the use of allocating cost to finished goods or WIP inventory in order to calculate net profit (Goldratt & Fox, 1993). Using this method, the plant managers, who successfully reduce inventory, may well find this reflected as a decrease in net profit. These authors also point out quite correctly that, because of lags, this method of cost allocation may very well produce good financial results in what is otherwise a poor performance period, and vice versa. This may influence senior management to make decisions in one period based on data related to a different period. When local performance measures meet global goals as well as local needs, it is possible to move to TOC management practices emphasizing throughput, reflecting the real value of money generated by the business, not a questionable accounting figure.

If KPIs are to meet global as well as local needs, they must reflect not only local performance, but how that performance impacts on the whole organization. Consider a commonly used measure of improvement, deliveries complete and on time, a non-financial, widely used, performance measure. If a unit of measure reflects only the number of orders not delivered on a due date, the length of the delay and the actual throughput is not recorded. An order of 1000 units a day late is recorded as one late order, an order of 10 000 units a week late is also recorded as one late order. A more appropriate measure would be throughput-dollar-days (Goldratt & Fox, 1993).

If a dollar value, such as the selling price, is applied to the units of the late or incomplete order and is multiplied by the number of days the order or incomplete amount is late, this measure will give a true reflection of delivery performance. If the selling price of the above example is \$1.00 per unit, in one case 1000 dollar days is recorded as late delivery, and in the other 70 000 dollar days is the value of late delivery, highlighting the impact on the firm, not just two late deliveries. This approach can also be used to reflect the performance of functional areas other than production. These examples suggest that an appropriate mix of financial and non-financial measures is required.

These difficulties do not mean that financial measurements should be removed entirely, only redefined.

### **The role of management**

Corporate reporting standards are set by external bodies, and these must be adhered to. It is claimed that these requirements, being common to all companies, impose the major requirements on the accounting system, such that cost accounting becomes a by-product, and is heavily dependent on the financial accounting system. This does not mean that internal reporting procedures must follow the same format. It is usually a relatively simple task for current information systems to record the required information, and the cost accounting system should be tailor made, not a by-product of another system producing doubtful information (Coulthurst, 1989, p. 39). Managers too often suffer with the problem of too much data and not enough information (Sink & Smith, 1993, p. 31). The problem of "sifting information out of the data ocean" is dealt with comprehensively in *The Haystack Syndrome* (Goldratt, 1990b). If organizations are to improve their business performance, a far more structured and informed approach to developing performance indicators is required. A greater understanding of the impact of performance indicators is imperative, at all levels of

an organization. There must be management awareness that for improvements to add to an organization they must be optimized. Too often firms improve quality and flexibility, reduce inventory or other such activities, yet do not translate these operational improvements into improved financial performance. While these improvements may not be immediate, for them to be worthwhile firms should register increased financial performance within a reasonable time (reasonable being an organization-specific value judgement). In many cases this does not happen, as management does not practise TOC management processes and is therefore unable to capitalize on these improvements of lower costs and increased capacity. It is not uncommon to hear comments such as “We’ve done TQM, it doesn’t work. In fact it only cost us money”, whereas the problem was not TQM not working, but support systems incapable of translating the results into improved business performance.

The significance of all levels of an organization, particularly senior management understanding the importance of appropriate performance measures and how to use these to achieve the strategic direction of the firm, cannot be overemphasized. When one is setting up a business process re-engineering programme, attention to an integrated performance measurement system should be a part of this process.

### Defining performance measures: A suggested approach

A starting point for this endeavour is the connection between company strategy, action programmes and their measurement, as expressed by Dixon *et al.*, (1990, pp. 5–7) and presented in Fig. 1.

According to Dixon *et al.* (1990), although strategies normally come first, it is not uncommon for strategy to change as a result of actions. The importance of measures can be seen in this context: if strategies and their supporting actions are to be successful, it is essential to measure the performance of these actions and their contribution towards strategic outcomes. When performance measures are selected within an organization the type of measurement should vary according to structural level. The higher up the organization the more important financial measures become. As one moves down to functional and operational areas, so the emphasis shifts from financial to more operationally focused indicators, such as scrap, cycle time or set-up time. It is equally important that top-level financial measures convey information to reinforce and appraise strategy and actions, as it is for those at shopfloor level. This may well mean a change in accounting procedures: possibly less ‘fudging’ of figures to meet remuneration criteria and end-of-period budgets. A recent inspection of a plant revealed an excessive amount of inventory relative to the size of the organization. In answer to the question ‘How much inventory is there?’ the comment was ‘Six million dollars, but only one million is usable’. Obsolete inventory was not written off over

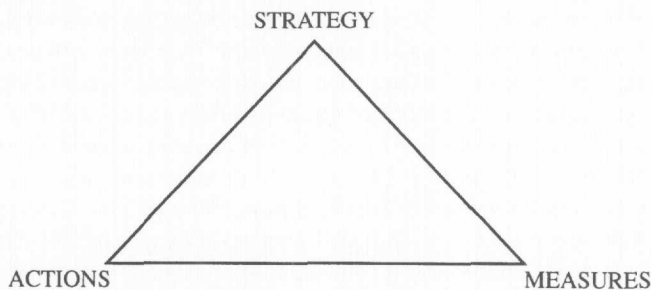


Figure 1. Interrelation between strategy, action and measurement.

time as this would mean poor results being reported to off-shore corporate headquarters. Situations like this are not uncommon, and certainly unacceptable and counterproductive to senior management making informed strategic decisions. Financial reports of this organization reported an accuracy of \$5 million in assets, so over a period of 5 years the bottom line did not reflect the true profitability of the business, as this inventory should have been recorded as a \$5 million write-off.

Performance measures must aim to achieving corporate objectives, even at the lower levels of an organization. Figure 2 presents a model for performance measurement within an organization that will meet corporate, functional and operational objectives. It also incorporates the integration of functional objectives. The emphasis is upon measuring across functions, not vertically within functional 'silos'. Developing and implementing such a system that meets all the organizational needs requires input from all levels, plus a company-wide commitment:

... the challenge is to derive systems and performance indicators that support strategic objectives and are consistent with factors critical to the success of the particular business ... Thus it is suggested that cost and management accounting requirements are—or should be—to a certain extent contingent on the characteristics of each individual business (Coulthurst, 1989, p. 38).

Maskell (1991, p. 40) acknowledges that performance measures will vary considerably by company situations but claims that they have seven common characteristics:

- they are directly related to manufacturing strategy;
- they primarily use non-financial measures;
- they vary between locations;
- they change over time as needs change;
- they are simple and easy to use;
- they supply fast feedback to operators and managers;
- they are intended to foster improvement rather than just monitor.

To Maskell's suggestions should be added measures related to monitoring corporate strategy, not just manufacturing strategy. These may be financial measures, depending on what is measured, and at what level of the organization. In focusing on improvement and monitoring, the control function is often forgotten; that is, control not in the sense of managers autocratically directing operators, but manipulating measures which convey information needed to control the business process. Monitoring and evaluation is normally an accounting function, and relies on historical data. So with a shift to current measures there is a major shift away from most companies' current management philosophies.

The balanced scorecard approach is an excellent starting point for developing performance measures which meet company needs as described above (Kaplan & Norton, 1992). The model, shown in Fig. 3, has two major advantages. First, it uses a strategic approach; this means that top management must be involved in the development of performance indicators. Second, the scorecard provides an excellent macro view of what the performance indicators should reflect, and helps to emphasize the linkages between performance measures.

If such a balanced scorecard approach is used, an understanding of the importance of these linkages will become more apparent throughout the organization. Recent case studies confirm the usefulness of the scorecard, particularly in organizations that are going through change. "I see the scorecard as a strategic measurement system not a measure of our strategy ... It is the responsibility of senior managers to ensure the scorecard becomes a lever to streamline and focus strategy leading to breakthrough performance and not be relegated to

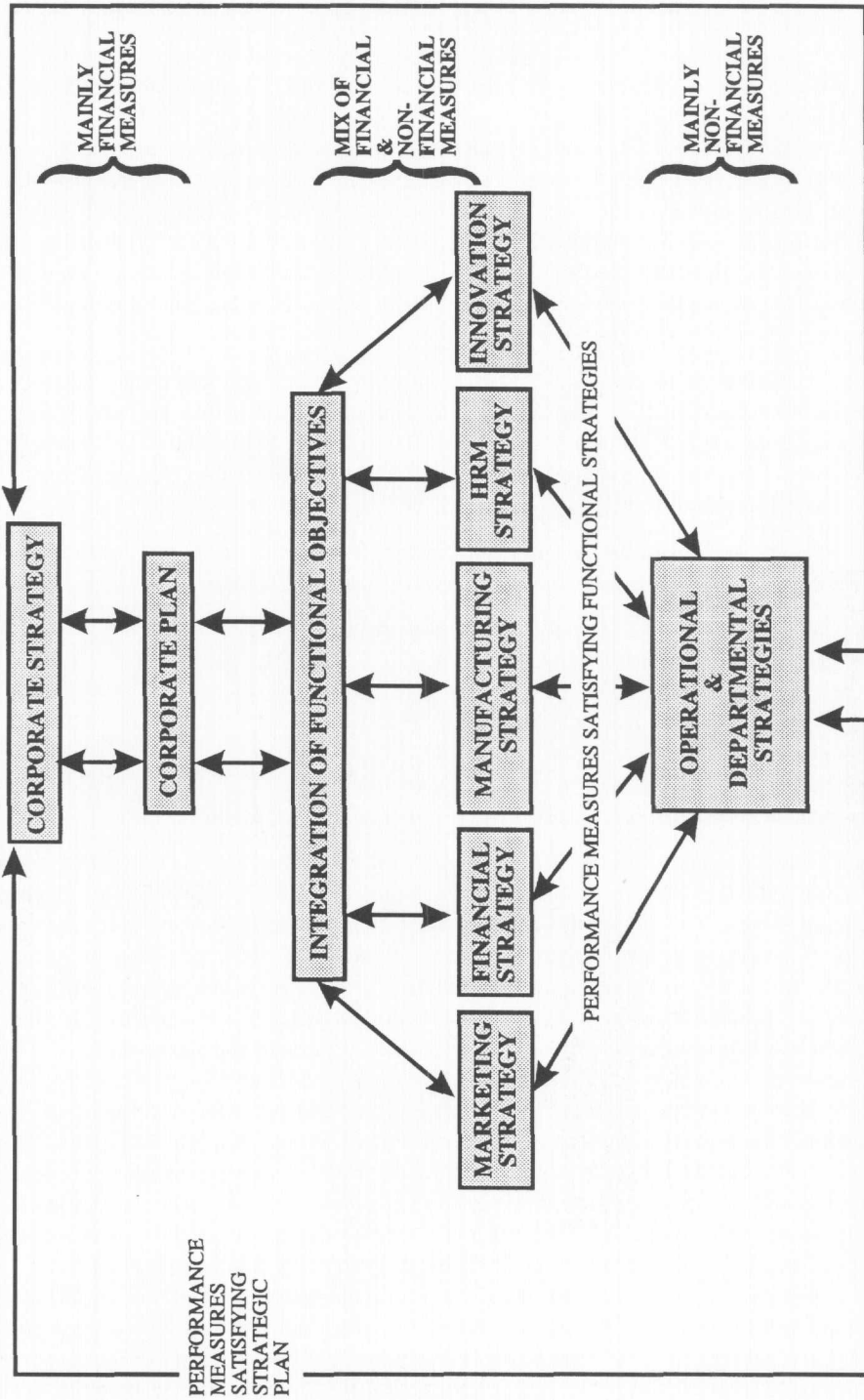


Figure 2. A strategic approach to performance measurement.



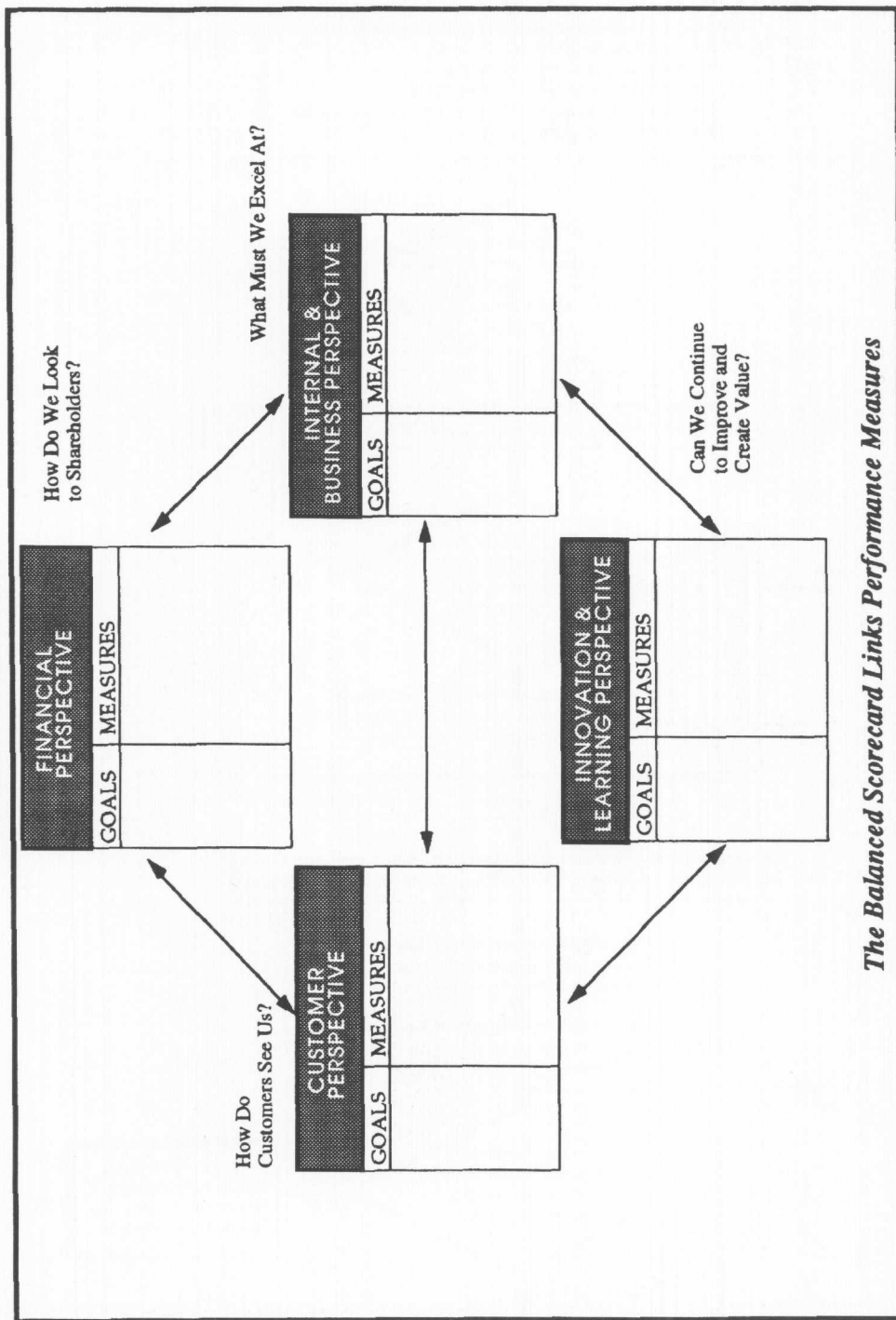


Figure 3. The balanced scorecard (after Kaplan & Norton, 1992, p. 72).

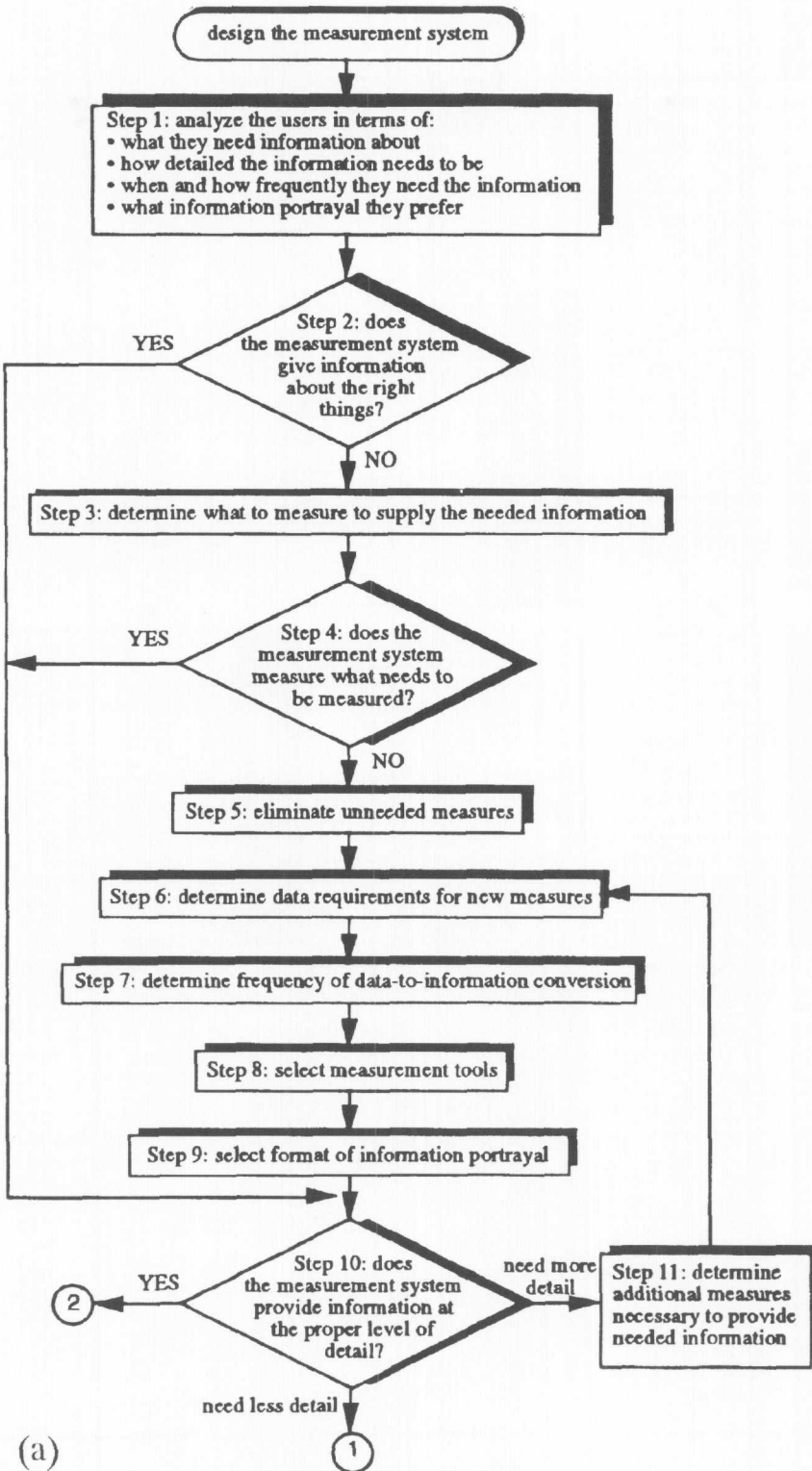


Figure 4. (a) Measurement system development consists of 20 steps (after Clark & Zirner, 1993, p. 73).

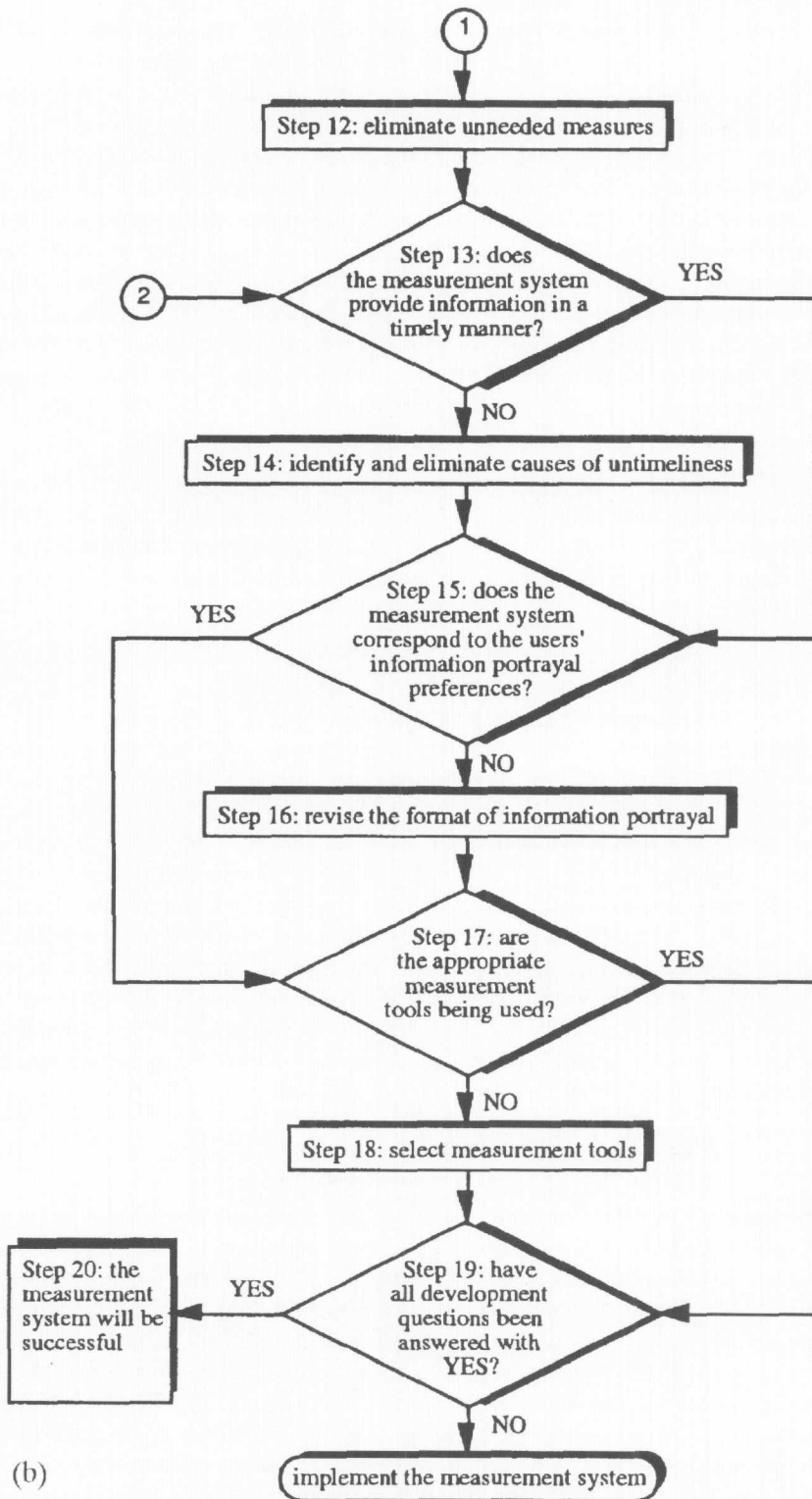


Figure 4. (b) Measurement system development consists of 20 steps (after Clark & Zirner, 1993, p. 73).

a mere record keeping exercise” (Kaplan & Norton, 1993). This overview of KPIs is well supported by a more micro approach to development and implementation, described by Clark and Zirner (1993). Their model for how to design a KPI system is presented in Fig. 4. Without going into detail here, the point to note is that to progress through the 20 design steps requires a great deal of consultation, both horizontally and vertically throughout the organization. Use of a performance measurement questionnaire (PMQ) (Dixon *et al.*, 1990, pp. 66–116) enables the organization to answer the questions addressed in the performance measurement model. The PMQ is not designed for the collection of data required to construct a measurement system. Rather it aims to focus on identifying areas for discussion related to congruence and alignment of the measurements with strategy, and the consensus that might exist with respect to these measures across the organization. The results of the questionnaire enable organizations to identify competitive priorities, performance factors and the level of consensus across the organization relating to these factors. ‘Gaps’ and ‘false alarms’ in the measurement system can also be identified. For example;

An improvement area gap signals the need for increased support for improvement in that area from the measurement system . . . In a false alarm the performance measurement system is ‘ringing,’ but no real problem exists! The problem is the performance measurement system is ringing for the wrong reason! (Dixon *et al.*, 1990, p. 74).

Redundant information is clearly identified via the PMQ, as well as essential requirements. The model has been successfully applied to a number of companies, such as the Northern Telecom case study reported by Dixon *et al.* (1990).

A possible model for the implementation of this measurement system is presented in Fig. 5. This approach to measurement actually draws on three models, and if applied with an understanding of the organization’s subsystems, outline in Fig. 6, the result should be a system that meets the requirements of all levels of an organization (Clark & Zirner, 1993). A safeguard is provided at point 19 of the design model introduced in Fig. 4 where, if all questions have not been answered satisfactorily, the designers still recommend the implementation of the system, but as a matter of course continue to complete any outstanding work, and feed back improvements as they occur. Step 5 of the implementation model is redundant if the balanced scorecard is used. As previously stated, one of the major strengths of the balanced scorecard approach is the involvement of senior management in the initial stages. Senior management must provide strong leadership and support for the whole process of the implementation of a KPI change programme is to succeed.

## Conclusions

If companies are to meet their strategic objectives, process capability analysis is a fundamental starting point. To know what the capability of an organization is at any given point in time demands a measurement system that conveys the requisite information. To plan the firm’s future direction also requires accurate and flexible measures. It is very difficult to know where you are going if you don’t know where you are to begin with. The days of manipulating accounting figures to meet budgets artificially must become a thing of the past if firms are to survive and prosper. Cutting the Gordian knot (Vollman, 1993), making a radical break between internal and external reporting and setting up an integrated approach to performance measurement is the first step. Techniques such as activity-based costing and activity-based management will help with developing such measures. These techniques can be used to identify profit drivers as well as cost drivers, and support the use of TOC management

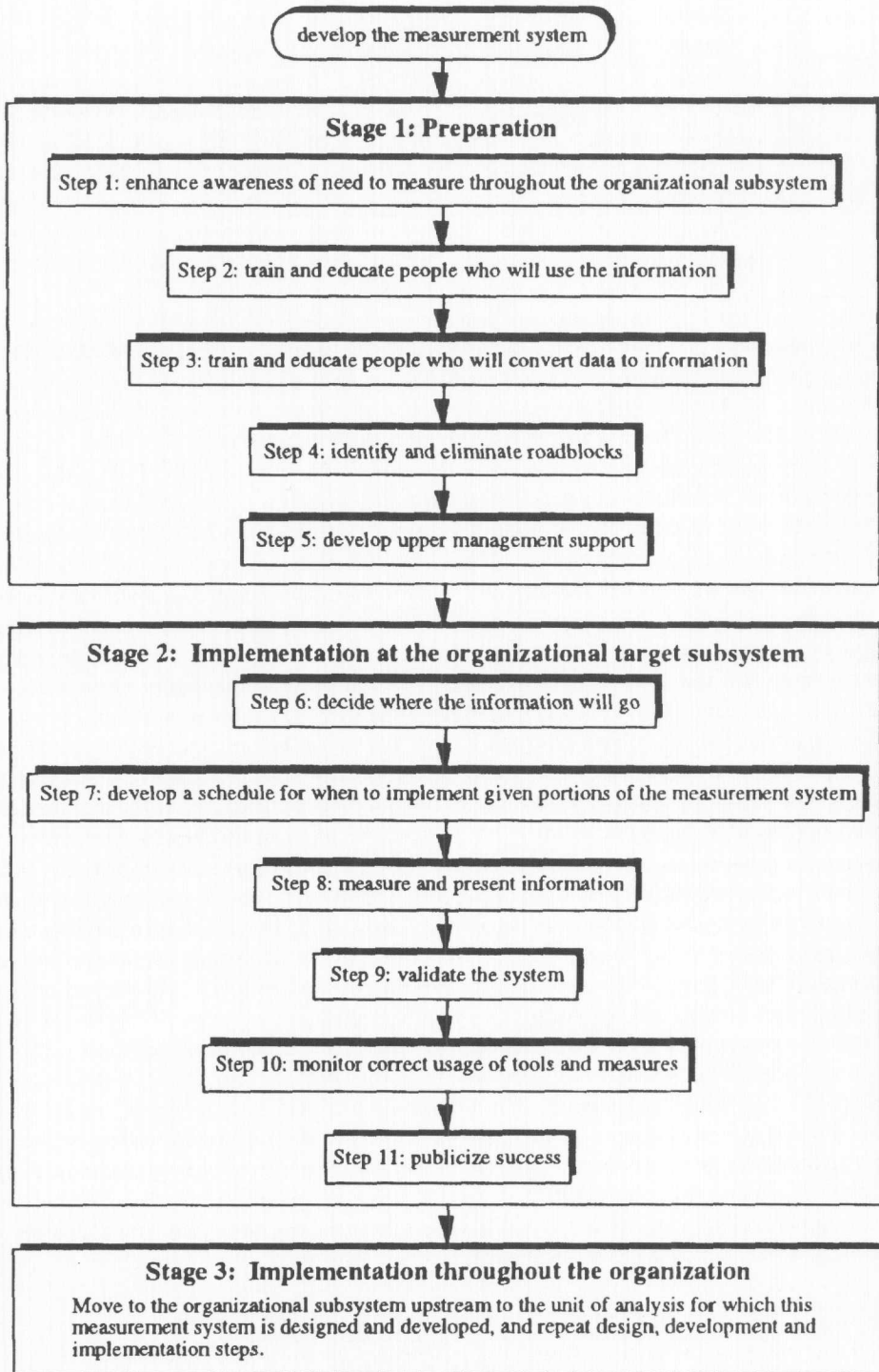


Figure 5. Measurement system implementation consists of three stages (after Clark & Zirner, 1993, p. 73).

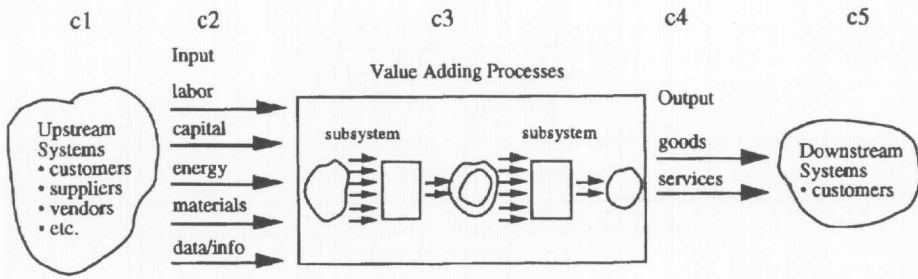


Figure 6. The organizational system (after Clark & Zirner, 1993, p. 63).

processes (Spoede *et al.*, 1994). Strategic approaches to market dominance, such as market pricing, cannot be employed successfully without an appropriate measurement system. As Daniel Goldin, the head of the National Aeronautics and Space Administration (NASA), has frequently emphasized, "If you can't measure it, you can't manage it" (Das, 1994). The basis of most enterprise agreements requires some form of productivity offset. Measurements like 'hours per unit' or 'direct labour ratios' suffer from the problems illustrated in this paper. Yet firms still endeavour to improve their manufacturing systems without attention to improving their performance measurement systems. One would not fly a Concord using Tiger Moth instrumentation, so why do we continue to use cost and management accounting measures developed in the early 1900s to provide information about production and distribution systems developed in the 1980s? Integration of management functions and education must be primary objectives if this situation is to be improved. All levels of the organization must gain a broad understanding of the linkages between measurement, improvement, strategy and financial performance. Scott Sink refers to a new 'science' of measurement emerging (Sink, 1991), where accounting departments must take a quality approach to meeting their customers' needs and be responsive to change, while still meeting their statutory requirements. Although inventory is regarded as an asset in financial reports, the key to eliminating the practice of continually manufacturing goods for finished goods inventory in order to inflate profit figures artificially must cease. If the accounting profession were to examine its reporting requirements to meet current industry needs it would be apparent that inventory valuation methods need a comprehensive overhaul. If a throughput approach is taken, only the inventory purchased from vendors as defined by Goldratt and Fox (1993)—that is, only the non-value added component of inventory—should appear as an asset. This would mean major changes to many balance sheets, which may well cause some financial instability. This does not mean it is impractical to implement, but rather that the process should be adopted gradually. It is of equal importance that bankers, financiers and investors who provide financial infrastructure acquaint themselves with current manufacturing systems and the necessary changes needed to change performance measurements used to evaluate of manufacturing performance (Bhimani, 1994).

In summary, Taylor and Convey (1993) believe there are three key rules essential to successful performance measurement systems:

- (1) Identify critical success factors.
- (2) Link performance measurement to critical success factors.
- (3) Measure only those factors that can be controlled.

The methodology outlined in this paper to develop a comprehensive system of performance measurements is generic. As the Taylor and Convey criteria suggest, any set of measures will

be organization specific: every firm is different. The important thing is an understanding of what you want to measure and why you should be measuring it. If any section requires more than six measures, there will be information overload. Some authors suggest four should be sufficient: the difficulty is in selecting the four. If the approach outlined here is followed there is a good chance that the system will meet the needs of the firm. No system will be perfect, but through continuous improvement the 'best' performance measurement system can be achieved and refined. "The bottom line, over the long term, is survival, growth, constantly improving performance, competitiveness, and behaving according to your values and principles. if you do these things, profits will follow" (Sink & Tuttle, 1990).

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