

# A STRUCTURED METHODOLOGY FOR DEVELOPING PERFORMANCE MEASURES IN ANY ENVIRONMENT

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## Abstract:

This paper starts off with reviewing the current developments in the area of performance measurement, considering the definitions used in performance measurement and, as the field is still rapidly evolving, the current meaning of the terms and then goes on to briefly trace the background to the development of performance measurement framework.

Managers need an effective process for designing measures to meet their unique and evolving needs. The objective of this work is to present a structured methodology for developing performance measures for a particular environment that can be used by any organization to define quality measures for control, assurance and improvement.

**Key Words:** Performance measures, Performance measurement frameworks, Structured methodology

## 1. INTRODUCTION

Managers need an effective process for designing measures which they can use to meet their unique and evolving needs. The first step is to determine the specific performance measurement issues (needs, requirements, etc.); once these are determined then one can think of the appropriate design of the system.

Research revealed two critical considerations with respect to the structure of performance measurement system: integrity and deployment. Integrity refers to the ability of the performance measurement system to promote integration between various areas of the business. Deployment refers to the deployment of business objectives and policies throughout the hierarchical structure of the organization [1].

## 2. PERFORMANCE MEASUREMENT- A REVIEW OF CONCEPTS

Performance measurement is a topic often discussed but rarely defined. Neely et al. have proposed definitions of performance measurement, performance measure and performance measurement system [2]. These were:

- "Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action".
- "A performance measure can be defined as a metric used to quantify the efficiency and/or effectiveness of action".
- "A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions".

Kennerley and Neely state that a performance measurement system has three constituent parts [3]:

- Individual measures that quantify the efficiency and effectiveness of actions.

- A set of measures that combine to assess the performance of an organization as a whole.
- A supporting infrastructure that enables data to be acquired, collated, sorted, analyzed, interpreted and disseminated.

Maskell reported that, although the performance measurement used by successful world class manufactures varies considerably, seven common characteristics can be identified [4].

These new performance measures:

- directly relate to the manufacturing strategy
- primarily use non financial measures
- vary among locations
- change over time
- are simple and easy to use
- provide fast feedback to operators and managers
- foster improvement instead of simply monitoring

The majority of performance measures chosen by world class manufacturers are not new, many of them have been used for many years. What is new, however is the importance attached to them.

A company will select a small number of key measures with which to monitor the progress of the business. Individual departments and plants will often have several additional measures giving managers, supervisors, and operators a more detailed analysis of factors affecting production. Too many measures can confuse people and obscure the company's strategy direction; there must be few enough measures so that the people can understand them and use them effectively.

The literature review has shown that performance measurement refers to the use of a multi-dimensional set of performance measures. The set of measures is multi-dimensional as it includes both financial and non-financial measures, it includes both internal and external measures of performance and it often includes both measures which quantify what has been achieved as well as measures which are used to help predict the future.

The Baldrige Criteria address four types of performance:

- 1.) customer-focused,
- 2.) product and service,
- 3.) financial and marketplace, and
- 4.) operational.

"Customer-focused performance" refers to performance relative to measures and indicators of customers' perceptions, reaction, and behaviors. Examples include customer retention, complaints, and customer survey results.

"Product and service performance" refers to performance relative to measures and indicators of product reliability, on-time delivery, customer-experienced defect levels, and service response time.

"Financial and marketplace performance" refers to performance relative to measures of cost, revenue, and market position, including asset utilization, asset growth, and market share. Examples include returns on investments, value added per employee, debt to equity ratio, returns on assets, operating margins, cash-to-cash cycle time, other profitability and liquidity measures, and market gains.

"Operational performance" refers to human resource, organizational, and ethic.

According to Neely et al. "performance measurement is the process of quantifying purposeful action where the process of quantification is measurement and purposeful action equates with performance" [5].

Performance measurement needs to be integrated into the management of the business and there are now management processes developed to do just this.

### **3. CHARACTERISTICS OF PERFORMANCE MEASUREMENT FRAMEWORKS**

It is undeniable that performance measurement and benchmarking became business buzzwords during the 1990s. Determining the best way to evaluate organizational performance is generally a very complex problem due to the diversity of criteria and dimensions of performance that need to be considered. Several performance models presented in the literature argue for introducing a selected number of key performance areas in order to obtain a valid holistic overview of the organization. The existing performance measurement frameworks display a number of key characteristics that help an organization to identify an appropriate set of measures to assess their performance.

- The work of Kaplan and Norton, their famous Balanced Scorecard providing a multi-dimensional corporate measurement system, and Keegan et al., that proposed a performance measurement matrix reflecting the need for balanced measurement, emphasize the fact that the set of measures used by an organization has to provide a “balanced” picture of the business. The set of measures should reflect financial and non-financial measures; internal and external measures; and efficiency and effectiveness measures [6, 7].
- Each framework demonstrates the need for organizations to implement a set of performance measures that is multi dimensional. This reflects the need to measure all the areas of performance that are important to the organization’s success. As underlined, the EFQM and the MBQA models provide the broadest indication of dimensions of performance to be measured.

It is widely accepted that organization performance needs to be viewed from several perspectives. The Balanced Scorecard meets this requirement with its four perspectives: financial perspective, customer perspective, internal business perspective, innovation and learning perspective as does a more recent measurement model, the Performance Prism), with its five facets: stakeholder satisfaction, strategies, processes, capabilities, stakeholder contribution [6,8].

The state of art review underlines six measurement perspectives: Stakeholder Contribution, Ecology, Reuse of assets, Invention of assets, New Product Development performance and Exploitation [9].

*Stakeholder contribution* - Many popular measurement frameworks comprise measure and structure addressing their stakeholders. The Balanced Scorecard reflects employees’ contribution on the “Learning and growth” perspective, the EFQM model has the enabler criteria “Leadership”, “People” and “Partnerships and resources”, the MBNQ Award model has the criteria “Leadership”, “Customer and Market Focus” and “Human Resource Focus”, the Performance Prism has adopted a stakeholder-centric view of performance measurement.

*Ecology* - An innovative organization requires knowledge of the context beyond company boundaries, such as competitors, regulators and the community. From a system’s view theory, the organization is part of a whole and thus should familiarize itself with internal and external elements of the system as closely as possible. An “Ecology” face therefore represents the need to manage and describe this enabling and influencing environment.

*Reuse of assets* - Reuse of knowledge assets is the first item of the innovation definition. The direct business impact of reuse was difficult to measure and operative and efficient knowledge management required a process-oriented view on reusable assets.

*Invention of assets*- Invention represents the second item of the innovation definition; as such, it is a further determinant of successful innovation in New Product Development. The symbiosis of reuse and invention, the need for knowledge-intensive companies to manage the intangible capabilities, and the prevailing application of similar concepts in the domain of performance management, give evidence for the useful inclusion of an “Invention” perspective.

*New Product Development Performance* - New Product Development process performance measures the resultant quality, time, costs and flexibility of process execution.

*Exploitation* -This perspective describes how reuse and invention correlate with commercial and financial success. In fact, reuse and invention have to contribute to delivery of marketable products and should be aligned with the strategic themes of the company.

Measurement frameworks guide companies in the selection of performance indicators. What has become evident is that these business solutions do not link multiple performance dimensions to the identification of best practice. It is then clear that one could use frameworks to guide the selection of measures, while a strategic performance management approach, such as data envelopment analysis, can be definitely be used to facilitate the integration of the measures for evaluation [10]. However, for this integration to be possible the variable-selection framework needs to consider the organization as a system with inputs, outputs and outcomes.

#### **4. MEASURING THE PERFORMANCE OF A PRODUCTION PROCESS**

Identifying key performance perspectives is important, but that alone will not give managers the information they need to improve performance. Kaydos identifies the variables that must be measured to properly monitor a production process, whether it is a department, a person, or a physical process [11]:

- Resource inputs are the money, manpower, and materials used to produce the products.
- Work inputs are the demands made on the production system. Orders to fill and the number of letters to be typed are work inputs.
- Environmental factors are forces or conditions outside the production system which affect its performance. Procurement lead time for materials and the unemployment rate are examples.
- Quality inputs are measures of the quality of incoming work. This could include measurements taken on incoming parts or raw material to determine if it is meeting specifications.
- Operational variance inputs are unrecognized quality problems generally not directly associated with the product. They are any deviation from ideal conditions from the customer's viewpoint in any phase of a production process. Illegible numbers on orders and missing dimensions on drawing are examples.
- Product outputs are the useful products or services produced. Pounds of yarn and telephone calls made are product outputs.
- Productivity is the ratio of output to input as discussed earlier. There could be several productivity measures of interest in a situation. Trying to combine all measures of productivity into one number isn't worth the effort. Besides, there is no generally accepted way to do it.
- Waste is present in most processes. Although we usually think of waste in terms of material, it is any resource that does not result in useful output. Measuring waste helps account for the gap between theoretical and actual productivity. Most companies are wallowing in waste and don't know it.
- Quality outputs measure how well the goods or services produced conform to their specifications.
- Variance outputs are a special type of quality measure.
- Performance, behavior and diagnostic measures. It is helpful to distinguish them as follows. Performance measures are the top level gauges of how well the production system is operating in a good/ bad sense. Behavior measures are the second level factors that explain how the major parts of the production system interact. Diagnostic measures are used to isolate problems to their actionable level. In the real world, a given measure could be wearing all these labels at the same time. The point isn't to put every measure in one class or another, but to think of these purposes when deciding what must be measured.

- Constraints are variables that must be held within certain limits. They can be real, like capacity limits, or conceptual, such as a maximum order processing time. In any case, constraint factors must be measured to assure they are not violated.

Measuring the entire right variable in a production system is the first condition for an effective performance measurement system, but it is not enough. To be effective, it will also have to meet the following requirements.

*Validity* - The performance measures must be valid; they must measure what counts and be accepted and understood by the users.

*Completeness* -The productivity and quality measures must be designed to prevent people from doing the wrong things as much as it will guide them to do the right things. It must be "closed" in the sense that it considers all aspects of balancing act that have to be performed.

*Sufficient Detail* - In information theory, there is a concept known as variety. It can be thought of as the number of different ways something can respond. As a system's variety increases, more information is needed to describe its behaviour.

## **5. METHODOLOGY FOR DEVELOPING MEASURES FOR A PARTICULAR ENVIRONMENT**

To address the weaknesses identified in existing frameworks, a novel methodology for developing measures in any particular Environment is proposed in the following sections. Since the measures reflect enterprise and process views of an organization, it is possible, with them, to measure both the operational and strategic components of an organization's approach to continued quality improvement. In addition, the methodology and generic measures are quite flexible. The measures may be applied within an organization to develop, maintain and improve a quality management system as just stated. An organization may utilize the information to support its development of a new quality management system or the maintenance and enhancement of an existing one.

According to Triantis et al. there are a number of general measurement principles that can provide guidance when an organization is developing its quality information system [12, 13].

First, measurement is not practiced in a vacuum but with the intent of facilitating process improvement and improving the organization's capability to practice total quality management. In this way, measurement can be viewed as belonging to something larger.

Second, measures should track quality management results. These results can be conceptually categorized according to whether they represent the organization's activities with respect to quality control/assurance or whether they represent quality improvement. Quality improvement can be subsequently viewed as being achieved either through process improvements (variability reduction) or through enhancing the organization's capability to improve its quality management activities.

Third, many organizations discuss, analyze, examine, study and evaluate errors, failures, defects, shortfalls and problems. These organizations for the most part, believe that one of the most effective ways to improve quality and productivity is to eliminate currently known errors. They seek to eliminate those errors in ways that insure they will not occur again, i.e., by improving the underlying production and management processes that produced the error in the first place. Thus, errors are made public by tracking relevant measures. This affects the way that organizations can observe errors and consequently they can eliminate them by measuring and decriminalizing them.

Fourth, in terms of the measures themselves, it is often believed that it is important to first start with a small set of measures that can be easily used. Additionally, measures should have a number of characteristics such as: a) Well defined; b) Practical; c) Quantifiable; d) Easy to access the data that support the measures; e) Cost effective; f) Measures that have stakeholder ownership, i.e., measures that stakeholders can understand and use easily; g) Measures for which automated collection and reporting is feasible.

Fifth, since measures are to be used by the stakeholders to facilitate quality control, assurance and improvement, it is important to motivate the main users of the quality measures. For example, managers need to learn the value of measurement and accept the added responsibility and cost of performing measurement. The value of measurement can be highlighted by showing how a manager's decision making capability is enhanced when he/she has access to an effective quality information system. For all stakeholder groups, it is important to define the objectives of measurement. Without clearly defined objectives, the process of measurement will appear as a futile task. Additionally, when defining and implementing measures, it is important to involve all the stakeholder groups. This is because measurement is used and perceived differently by the different groups. Also by involving all the parties concerned, one is a step closer towards achieving trust with respect to measurement and has a greater possibility of achieving consensus in terms of quality improvement objectives. Finally, the definition, analysis and evaluation of quality measures require formal education and training.

Sixth, since measurement is usually part of a culture change necessary to achieve quality improvement, it needs to be viewed as part of the continuous improvement paradigm. This involves the continuous development of the measurement process which requires regular reviews. This continuous development of the measurement process implies that organizations may need to throw away some or all of their initial measures. Many organizations pilot test their measurement system, knowing that some parts of it would survive scrutiny and that other parts would have to be revised. Thus, pilot measurement programs can help organizations learn how to change and identify measures that lack merit.

Seventh, the value of the best measurement programs will be diminished if the people who have managerial and decision making authority do not receive the information. Measurement reports must be relevant, timely and limited to that information needed for the individual to make a decision. Finally, measurement and process improvement take time. They require more than just defining and establishing a program. They dictate a change in attitude, a shift in culture and these do not happen quickly. The change requires years and must be continually reinforced to survive and grow.

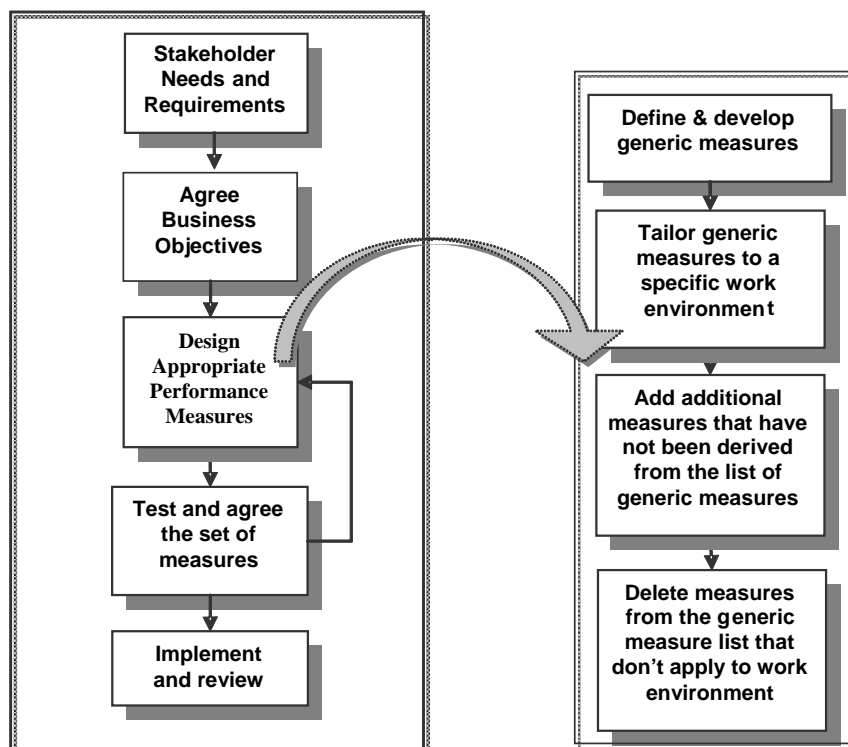


Figure 1: A structured methodology for developing measures for a particular Environment.

The approach uses a structured methodology, designed to be utilized in any organization within the government or private sector, service or manufacturing industries, which considers the physical, information and decision making systems in the development of performance measures. There are five stages in this approach. The design of a performance measurement framework for any complex system requires that it first address a number of measurement needs/requirements.

The process begins with the detailed analysis of the system, capturing the control mechanisms and information flow structure (Fig. 1).

It is very difficult to introduce pre-defined or selected measures in a company. The measures themselves (not the way they are structured!) are always very unique and specific for a company and have therefore to be developed individually with a great level of detail and accuracy.

The selection of measures represents an important tool for efficient and effective construction and implementation of the system.

To Design appropriate performance measure four steps are pointed out:

- *Define and develop generic measures.*

Determine what must be measured in a quality management system to obtain a comprehensive view of how well the system is functioning.

Determine what must be measured to determine the weakness and strengths of a system as they are perceived by an organization's stakeholders.

- *Tailor generic measures to a specific work environment.*

Highlight each measure and define it within the context of a particular work environment. Identify example of processes or activities unique to the environment that might be measured.

- *Add additional measures that have not been derived from the list of generic measures.*

Add any additional measures pertaining to the work environment not already included in a list of generic measures.

- *Delete measures from the generic measure list that don't apply to work environment.*

Delete those measures that exist in the generic list that do not apply or are not needed in the list of specific measures.

At each step in formulating measures, the following questions would be considered and applied:

- Will the measure have meaning to a management team?
- How realistic is the measure? How likely is it that it will "work"?
- Can the measure be worded simply and in unambiguous terms?
- If a ratio is necessary- for example between inputs and outputs- can it be properly defined and consistently applied?
- Will the value of measure justify the cost required to collect, store, retrieve and portray its data?
- Does the measure support the overall objectives and philosophy of Total Quality Management?

When applied, the above methodology gives rise to a set of measures that are quantitative and qualitative in nature. Appropriate units have to be applied to those that were quantitative and an appropriate scale for qualitative measures developed.

## **6. CONCLUSION**

The literature review has shown that performance measurement refers to the use of a multi-dimensional set of performance measures. The set of measures is multi-dimensional as it includes both financial and non-financial measures, it includes both internal and external measures of performance and it often includes both measures which quantify what has been achieved as well as measures which are used to help predict the future.

Many Performance Measurement Frameworks have been developed to help organizations design a set of performance measures that appropriately assess their success. These frameworks assist organizations in a number of different ways, each having its strengths and weakness. The key attributes of existing performance measurement frameworks have been presented that enable them to help organizations identify the set of performance measures that appropriately reflects their performance and objectives.

In contrast to many of the existing frameworks, the authors offer a methodology to build a structured and systematic repository of suitable and generic measures, which reflect qualitative aspects of quality management system activities. As shown, there are a number of general measurement principles that can provide guidance when an organization is developing its quality information system.

It is important to underline that one of the basic assumptions of this methodology is that measurement for Total Quality Management development will not be successful unless top management is committed.

A central issue that needs to be addressed is the allocation of resources for quality measurement. Resources need to be allocated first at the strategic level and then distributed when the quality measurement system is being designed and developed.

Performance measurement could be an expensive task for the organization. Its justification can be achieved if specific improvement and cost savings results are achieved as the result of quality measurement.

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