What to Measure and How

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Information is not knowledge. Just as copy machines fill shelves with unused documents, information technology provides the capability to inundate overwhelmed employees with irrelevant facts. We need to examine our management information systems for utility, and discard measurements that are not used for decision-making. When measurement is used as a means to acquire knowledge, rather than as an end it itself, the result is sound decisions that improve the quality of organizational processes.

Introduction

Improvement emanates from change, but not all change produces improvement. If a change is introduced into a process, what guarantees that the new way will be better than the old? Best efforts will not suffice, best efforts must be guided by knowledge. W. Edwards Deming often warned:

> *"An unstudied solution to a problem may yield immediate results in the right direction, yet in time bring disaster."*[1]

Solutions should address the underlying causes of performance. Without understanding of cause, change is trial and error. It is irresponsible to disrupt an organization with unstudied change.

Measurement is a requisite for beneficial change. The soundness of our decisions is directly related to our knowledge of the dynamics of the process in question. Measurement develops the knowledge that enables us to create beneficial change.

Determining what to measure

Measurement develops knowledge when it provides the information we need. The right information is generated by posing a questions, and collecting *only* the data needed to answer the question. The type of data required is a function of the question. Some questions require system level measures of outcome; for example; ***How are we doing versus our competitors?*** Other questions require process level measures to locate causes: for example, ***Why are we not meeting delivery schedules?***. System and process level measures are differentiated as follows:

System Level Measure

- Organizational objective
- Interaction of several processes
- Outcome measure
- Focus on results rather than cause

Process Level Measure

- Operational objective
- Related to specific process
- Provides feedback for causal analysis

Tom Nolan provides a model for improvement comprised of three questions.[2]

MODEL FOR IMPROVEMENT

AIM	What are we trying to accomplish?
MEASURE	How will we know that a change is an improvement?
CHANGE	What changes can we make that will lead to improvement?

The first question establishes an objective to be accomplished. The second question requires a system level measure to determine whether the change produced the desired result The third question usually requires a process measure is to predict what changes will lead to improvement.

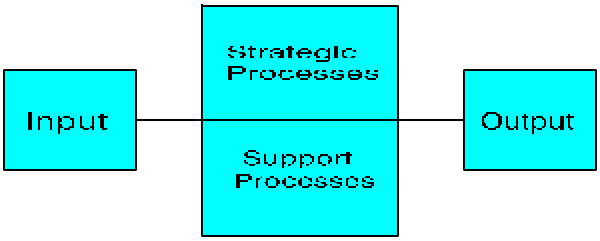
What do we want to accomplish?

This question sets the focus of an improvement effort. At the system level, the aim is the mission of the organization. At the operational level, the aim is a specific objective aligned with the mission.

The boundaries of the core system are defined by the aim. Many health care systems have changed their aim from "Improve patient's health status" to "Optimize health status of the community." The new aim promotes more outreach preventative services designed to reduce the number of hospital inpatients.

Deming defined a system as "*a network of interdependent components that work together to try to accomplish the aim of the system*." The simplified model below depicts the system as a series of strategic and support processes.

DSMC System Model



Strategic processes are a handful of core processes that define an organizations reason for existence in terms of what it is trying to accomplish. The aim of strategic processes is to meet the needs of external customers. DSMC's strategic processes are:

- Education and training
- Research
- Consulting
- Information Dissemination

Support processes enhance the efficiency and effectiveness of strategic processes. For example, the Lionheart system for on-demand printing enables faculty to incorporate the latest policy and procedural changes into course materials, thereby improving the education process. The primary customers of support processes are internal. DSMC's support processes include:

- Financial management
- Procurement and contracting
- Facilities maintenance
- Printing and duplicating
- Audio visual services

How will we know that a change is an improvement?

Goals and objectives derived by answering the first question are often too ambiguous to serve as a basis for action. The second question impels us to

translate the objective into an explicit indicator that everyone can understand.

DSMC's mission is "*...to promote and support the adoption and practice of sound systems management principles by the acquisition workforce...*".[3] If the method of delivering education is changed to a more learner driven approach, how will we know that the change produced the desired result?

Graduate performance scores in required competencies indicate the extent to which systems management knowledge has been gained. However, the mission transcends beyond accumulation of knowledge. The mission is to ensure that the knowledge acquired is put into practice to improve the efficiency and effectiveness of weapons systems acquisition. Therefore, an answer to the second question requires a measure of the job performance of acquisition managers.

If possible, a change is pilot tested on a small scale, and incorporated system wide once it has been confirmed that the change is indeed an improvement.

Data collected prior to the change is charted to establish a baseline for process performance. Once the change is introduced, a comparison of before and after quantifies its impact.

What changes can we make that will lead to improvement?

Any change introduced into a process is a prediction that the new way will be an improvement over the old. The prediction should be based on knowledge of the causes of process performance. Such knowledge is attained through the scientific method of investigation. Subject matter expertise guides the investigator to ask questions of the process and target data collection and analysis accordingly.

Deming categorized process causes into two types:

> **Special Causes:** Variation caused by special circumstances that can be pinpointed to a specific time or location.
>
> **Common Causes:** Net effect of numerous sources of variation inherent in the current system.

Ascertaining the cause is essential to beneficial change, because the type cause dictates the type of intervention needed. Special causes are correctable through local action by personnel who execute the process. Common causes can only be corrected by those with the authority the change the system.

In his study of successful interventions, Peter Drucker observed that the most profitable source of innovation is discovering and exploiting successes within an organization. Boundless innovations are overlooked in most organizations. Drucker attributes this blindness to the format of existing reporting systems. Data must be analyzed to pinpoint successes.

An educational institution exploited success by isolating exceptional instructors through comparative analysis of student evaluations. The exceptional instructors became mentors to the rest of the faculty, resulting in an improvement in quality of all the courses.

A keen understanding of cause and effect is needed to implement a change that addresses the process drivers. Development processes are driven by schedule. When milestone are not met, managers compensate by assigning additional people to the project or increasing overtime. Both solutions increase error rates, thereby increasing the backlog.

The system level measure of the timeliness of a development effort is the extent to which delivery milestones are met. A useful process level measure is cycle time relative to plan. Cycle times significantly greater than plan indicate that prompt investigation is needed. The investigation may disclose unclear requirements or overly optimistic schedules. Program managers who monitor cycle time circumvent schedule overruns by discovering problems at their onset and responding with the appropriate intervention.

How to measure

Data that serves a basis for decision-making must be valid and reliable. Valid and reliable data is the product of a consistent methodology to collect and record the data.

An example will demonstrate the point. If we wish to measure employee absenteeism, what do we count as an absence? Do we count scheduled doctor's appointments for a portion of the day, or only unscheduled full days missed? The data is not comparable unless everyone is counting the same way.

An ***Operational Definition*** transforms a measure into a metric. A metric has an explicit procedure for observing and recording the data. The following table depicts some examples of measures and their corresponding metrics:

MEASURES & CORRESPONDING METRICS

MEASURE	METRIC
Throughput	# DSMC graduates per fiscal year
Data Reliability	# Mismatched Records
Absenteeism	Absent days / total workdays
Response time to information requests	# Workdays between request for and delivery of information
Operating Efficiency	Cost per student week
Student Achievement	% Improvement in post-test scores
Systems Management Excellence	Job performance ratings by supervisors of DSMC graduates

Endnotes

1. Deming, W. Edwards. Remarks during seminar; Instituting Dr. Deming's Methods of Productivity and Quality. Arlington, VA, March 30, 1993.

2. Nolan, Thomas W. *Making Changes that Result in Improvement*. International Deming Users' Group Conference Proceedings, August 1993.

3. *Defense Systems Management College 1995-1996 Catalog*. Fort Belvior, VA: DSMC Press, 1995..

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