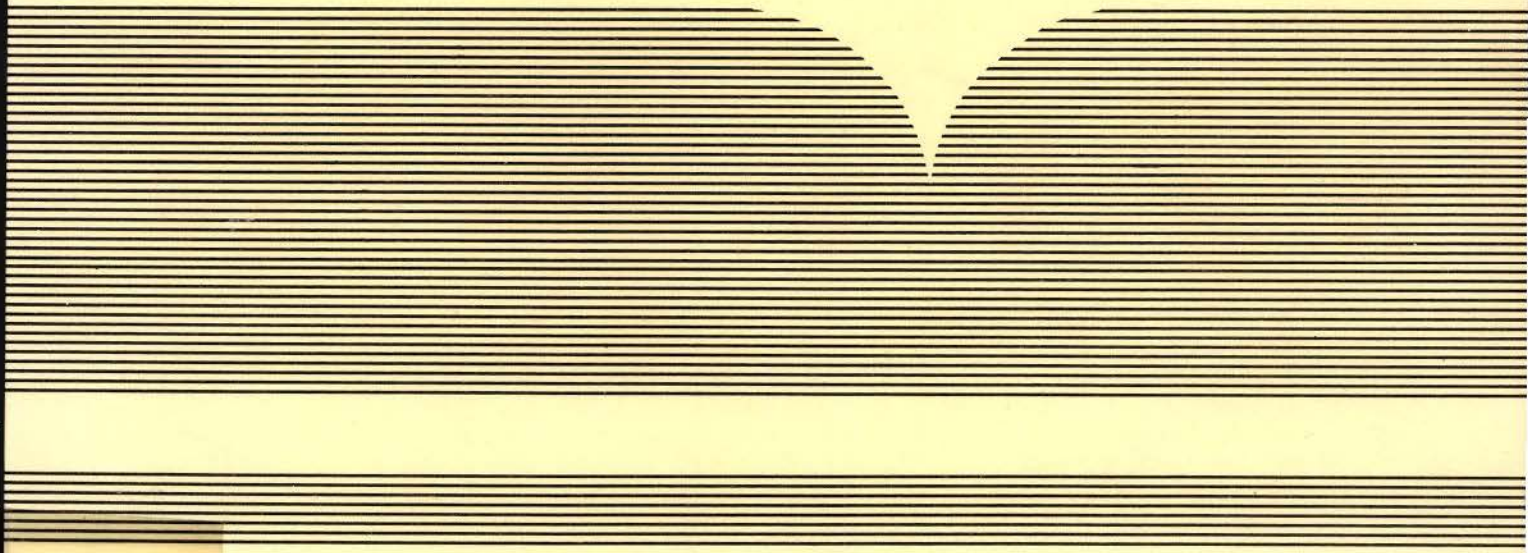# HOW TO DEVELOP QUALITY MEASURES THAT ARE USEFUL IN DAY-TO-DAY MANAGEMENT

**OFFICE OF MANAGEMENT AND BUDGET
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HOW TO DEVELOP QUALITY MEASURES THAT ARE USEFUL IN DAY-TO-DAY MANAGEMENT

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13. Abstract: This is a paper prepared by staff of the Federal Quality and Productivity Improvement Program in the Office of Management and Budget to provide information on constructing useful quality measures. The paper describes step-by-step methods that can be used, and provides examples of quality measures that are being used in both private and public sectors.

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HOW TO DEVELOP QUALITY MEASURES THAT ARE USEFUL IN DAY-TO-DAY MANAGEMENT

INTRODUCTION

Federal agencies across government are being challenged to achieve the goal of the Federal Quality and Productivity Improvement effort: to provide high quality, error-free, and timely products and services to the American public that are responsive to customer needs and make the most effective use of taxpayer dollars. The emphasis is on *continuous improvement* of operating processes to achieve better products and services and thus, attain greater customer satisfaction.

One critical element of managing for continuous improvement is to know the *level of quality being achieved* at any given time and this requires the use of quality measures. Without *quality measures*, it is entirely possible to be talking about quality improvement while quality is, in fact, declining. Measures enable managers to know how close they are to their targets and how to make the right decisions for improving work processes. In short, *measures support improvement*. This is their key purpose.

The purpose of this paper is to provide information on constructing useful quality measures. Timeliness measures also figure prominently in the paper, but are considered a sub-set of quality, rather than given separate treatment. Efficiency and effectiveness measures, although extremely important for good management, are beyond the scope of this paper. Nor does this paper attempt to discuss the larger context of "Total Quality Management."

The paper describes, step-by-step, various methods that can be used to develop quality measures and provides numerous examples of quality measures that are being used in both the private and public sectors. The paper begins with a brief discussion of: 1) the definition of quality; 2) the importance of quality to an agency's mission; and 3) who should be involved in developing quality measures.

WHAT IS QUALITY?

Quality is the extent to which a product or service *conforms to requirements* and *meets customer expectations*. "Customers," in the simplest terms, are the persons or groups for whom the work or service is performed. Customers may be either internal or external to the agency. These distinctions will be discussed in later parts of this paper.

In the public sector, "conforming to requirements" means that the product or service conforms to the legislation, regulations, and policy guidance established for the product or service. "Conforming to requirements" sets a *basic threshold of quality* that is usually established by Congress, defined by legal or subject matter experts, and interpreted through Administration policy. Requirements are therefore heavily (though not exclusively) oriented to an internal, insider viewpoint, rather than a user viewpoint. "Meeting customer expectations", on the other hand, ensures that the users' views are also taken into consideration. Both dimensions are important.

In most Federal program functions, managers have considerable latitude to act where laws, regulations, and policy are not specific about methods of service delivery. These are the areas where managers have maximum discretion to heed customer views and try to "*meet customer expectations*". For example, in processing grants, applications, loans, licenses, and payments or in inspecting mines, meat and poultry, hospital records, and suspected pollution sites, it is essential to the quality of service that laws, regulations and policy are followed. But, in addition, quality should also include other characteristics that are important to customers: a simple, easy-to-understand application process; courteous, quick and accurate response to questions concerning any aspect of the service; timely completion of the service; quick correction of any mistakes made; follow-through by a single person on any problem encountered (in contrast to dealing with 10 different people, none of whom seem to follow through to problem resolution); accessible service at hours convenient to the customer; communication to customers of any changes to normal procedures well in advance, etc.

Although both dimensions of quality--conforming to requirements and meeting customer expectations--need to be emphasized, good judgement must be exercised when any basic definition is operationalized in a complex environment. All quality experts (focusing primarily on the private sector) agree that a customer orientation is essential, but not to the extent of flouting laws or good engineering, scientific or medical practice. The same holds true in the public sector where agency managers must conform to requirements even when their customers' expectations are not met. For example: HHS, NSF or NEA in denying funds to potential grantees; SSA or VA in denying benefits to certain disabled groups; IRS in penalizing a taxpayer; USDA, Commerce or SBA in denying a loan; EPA, Labor, or EEOC in fining certain businesses -- all may have based their decisions on the application of appropriate statutes, regulations, due process requirements, and scientific evidence and in the process not met these customers' expectations. Unfortunately, some customers' expectations are unrealistic. Most public sector managers would agree, however, that they could probably do a better job of explaining their regulations and policies to the public so that their customers have a better understanding of what is possible.

Even in the complex environment of government, agency managers can try to meet customer expectations by soliciting customer views during policy-making and planning efforts, getting information out to customers in clear English, and explaining the reasons for decisions when customers are not satisfied. All customers should feel they have been treated fairly and equitably, even if they are not entirely satisfied.

A customer orientation is essential in the public sector because it is very easy to fall into the trap of defining quality solely from an internal perspective--letting professional experts (engineers, lawyers, doctors, researchers and a variety of specialists) establish quality measures and standards -- and lose sight of the users' perspective.

To repeat the definition of quality: quality is the extent to which a product or service conforms to requirements and meets customer expectations. The challenge for managers is to take seriously both dimensions of the definition in developing quality measures and in implementing quality improvements.

1. External Quality

There are both internal and external aspects to quality. Internal quality will be discussed in the next section. *External quality in a service-oriented function refers to the quality of the final service received by the customer.* Metropolitan Life Insurance Company discovered that customers of services find these quality attributes to be most important:

1) <u>tangible aspects</u> -- the condition and appearance of facilities, personnel, etc. are suitable;
2) <u>reliability</u> -- service is dependably and accurately performed;
3) <u>responsiveness</u> -- help and service are willingly and promptly provided;
4) <u>assurance</u> -- employee knowledge, courtesy and trust are consistently conveyed; and
5) <u>empathy</u> -- individualized attention is provided to customers.

Note that these attributes concern "how" the customer and provider of service interact -- this is the behavioral aspect of service. The actual service delivery (such as the repair, loan, grant, payment, medical treatment, information, training, or audit) is the *"what"*, or other aspect, of service. Both aspects -- *the "how" and the "what"* -- have routine and non-routine properties which together comprise four dimensions of service quality as illustrated by the claims payment matrix below.

CLAIMS PAYMENT

	ROUTINE	NON-ROUTINE
SERVICE BEHAVIOR ("HOW")	Behavior of claim approver as a *provider* of service	Dealing with a customer whose bills were not completely covered
SERVICE DELIVERY ("WHAT")	Make accurate payment within two weeks of claim receipt	Provide explanation of correctness *or* corrected payment

Often, managers focus only on the lower, left quadrant -- or the routine service delivered -- in measuring the quality of service and ignore behavioral interactions with customers, particularly in non-routine situations. Non-routine situations occur frequently due to unforeseen occurrences (special requests, breakdown in the normal transaction). For example, someone fails to understand eligibility requirements. Measuring customer service to achieve improvements has to be based on the actual experiences that customers face and these include all four quadrants.

Additional characteristics of quality service are contained in Attachment A, the results of a Gallup Survey taken in the Summer, 1988.

In many cases, agencies provide their services to "intermediaries", such as state and local governments, who in turn provide services to the public. In these cases, state and local governments are the *direct* or *immediate customers* of Federal agencies' outputs or services. Agencies should develop quality measures that focus on the needs and expectations of these customers who directly use the agency's output. These measures are most relevant to agency management because the emphasis is on factors within the agency's control.

Focusing on immediate customers does not mean that *ultimate* customers, the public, are ignored. Rather, the tools used to assess whether ultimate customers are receiving quality service are not quality measures, but the results of program evaluation. Program evaluation assesses whether the service provided by the agency is achieving the *outcomes and results* expected from the program. Evaluation should be used by managers to improve their services and to ensure that the *right* output is being produced. But program evaluation is a separate activity (and should be performed by an outside group) from measuring the quality of an agency's output. For example, the Food Safety and Inspection Service (FSIS) of the Department of Agriculture annually conducts the inspection of billions of pounds of meat and poultry products (output or

service provided). The intended result of this service is public protection (outcome). Other factors affecting public protection are conditions of handling, shipping, refrigerating and storing the product until sold and its ultimate preparation in the home or restaurant. The FSIS is not able to directly affect these variables. Quality measures for the FSIS inspection function should first focus on the quality of their inspections, the agency's direct output or service. The results of program evaluation should address ultimate outcomes and variables beyond FSIS control and should be used by FSIS, as appropriate, to plan improvements to their operations.

2. Internal Quality

Internal quality pertains to the quality of the work processes that are used to produce the final output or service. The ability to meet requirements and customer expectations requires a *quality process* in place to create the output. A quality process is one which converts raw materials or information into completed services with each step in the process adding value toward completing the final service. Since these steps are "value-adding activities"[1] and usually produce intermediate outputs, their effect on the final output's quality is substantial. Measuring internal quality in the USDA/FSIS example cited above would focus on the steps in the process of inspecting meat and poultry to be certain that each step adds value to the whole process (e.g., no duplication or unnecessary steps, no errors or deficiencies) and is performed thoroughly, accurately and according to prescribed standards.

Most government functions that provide a service to the public are comprised of several work groups that produce intermediate outputs. While there may be only one final external customer, each of the work groups may also be thought of as a customer with some previous work group in the process as its supplier. The following figure illustrates how requirements and customer feedback drive the process as it converts supplier inputs into outputs delivered to customers.

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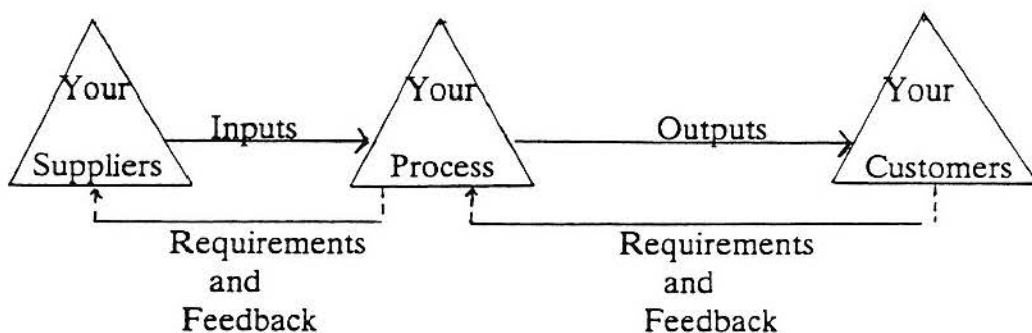
[1] Value-adding activities are those which, under vigorous examination, cannot be eliminated without detriment to the final product or service.

To sum up: quality means conforming to requirements established by law, regulations and policy, and meeting customer expectations. In the service sector, customer expectations go beyond the routine aspects of the actual delivery and also include the behavior of the service provider and all non-routine dealings between customer and provider. Condition and appearance of facilities and personnel, reliability, responsiveness, assurance and empathy are key attributes that are important to many customers. Quality measures should be directed primarily at customers who are the immediate users of an agency's output and should assess how well their expectations are being met. The findings of program evaluation are essential to determine whether ultimate customers are receiving quality service. These findings should be used by program managers to ensure that the right output is being provided. Satisfying customer expectations requires the development of internal quality measures of the work processes used to provide the service. Each work group should "add value" to the output and seek feedback from the next work group (its customer) receiving the work product.

If quality service is important to an agency, the managers and employees will establish quality indicators in response to the following questions:

	o Who are my direct customers?
	o What do they need and expect?
External Quality	o Do my products or services meet
(Product/Service)	their expectations?
---	---
Internal Quality	o What is my process for meeting
(Process)	customer needs and expectations?
	o What corrective action is required
	to improve my process?

WHY SHOULD QUALITY BE MEASURED?

Quality is important in achieving an agency's mission, since the way a service is delivered to and perceived by the customer affects the outcome targeted by that service. Citizen feedback about the accuracy and timeliness of services such as mortgage insurance, educational loans, passports, tax refunds, social security or veteran's benefits provides evidence of that relationship. It is equally true for outputs that do not go directly to citizens but to intermediaries, such as state and local governments. For example, how a Federal grant program is delivered to a state or local government can either facilitate or impede that government from carrying out its work and ultimately having the desired impact on the public.

The only way an agency can know whether it is attaining the quality it wants, meeting customers' expectations, and using work processes that maximize quality is to measure the level of quality in all these areas. Quality measures also enable managers to plan improvements in their operations and verify whether changes introduced are accomplishing objectives. Having measures provides the most reliable basis for day-to-day management decisions.

With quality measures managers are able to answer the questions, "Are we doing the job?" "Are we getting better?" "Where are the problems occurring?" "Where is corrective action needed?" Where good measures exist, good planning and evaluation are not far behind. Evidence also shows that where measures are used to make needed improvements, employees are less resistant to measurement because they see its positive role rather than its control orientation.

There are many benefits of quality measures, often dependent on the process used to develop them. Benefits include:

1. Knowing that customers are receiving a specific level of service because the indicators are measuring it accurately.
2. Providing a way to give concrete feedback to a work group and to verify its progress.
3. Establishing a basis for reward and celebration.
4. Providing a means of assessing progress and signaling the need for corrective action.
5. Reducing the costs of operations by eliminating costs of defect correction.

WHO SHOULD DEVELOP QUALITY MEASURES?

The usefulness of quality measures is often dependent on who participates in their development. Carl Thor, President of the American Quality and Productivity Center, suggests that ideally, to ensure fairness and commitment, three actors -- the supplier of inputs, the employees of the organization providing the service, and the user/customer of the service -- should construct the measures. If direct personal involvement of suppliers or customers is difficult to arrange, at a minimum, information obtained from surveys should be used to understand the requirements of any absent group. The working team should consist of employees drawn from all groups involved in work related to providing the service, of individuals who will analyze and use the measures, and those who monitor the work process. An effective tool for coming up with good quality measures is the Nominal Group Technique, a structured participative approach that capitalizes on maximum input from all participants. A brief description of this method is at Attachment B.

In the remainder of this paper, various methods that a team could use for developing quality measures are discussed in a step-by-step fashion. There is no "one best" way to develop quality measures. Agencies should adopt a specific method only after reviewing alternative approaches and finding one that best fits their needs. The important thing is to begin tracking the level of some quality attributes because this provides the impetus for improvement. Examples and worksheets are provided in the attachments to simplify development.

METHOD 1: A GENERIC METHODOLOGY FOR CONSTRUCTING QUALITY MEASURES

A fairly generic approach is to translate attributes of quality, as defined by customers, into indicators or measures of quality. This technique relies on working through a step-by-step process that results in the final product/service.

1. Identify all customers of the program's outputs -- products and services -- and those customers' requirements and expectations.

One needs first to answer the questions: "Who are my customers?" "For whom are we producing a final output (service or product)?" When this is answered, the next step is to define those customers' needs and expectations by asking them the question, "what are the quality attributes (e.g. accuracy, consistency, clarity, responsiveness) that must be satisfied to meet your expectations and requirements?" This procedure should be followed for each output. The chart below (and worksheet 1) considers the discretionary grants function in the Department of Education (DEd).

OUTPUT	CUSTOMERS	EXAMPLES OF CUSTOMER REQUIREMENTS AND EXPECTATIONS
1. Discretionary Grants	Local school district, public/private educational institutions.	1) Grant payment is timely, accurate and hassle-free; 2) Grant-related correspondence and documentation are accurate and clear; 3) DEd monitoring behavior is consistent, fair, and based on accurate information; 4) DEd is available and responsive during the grants processing and administration cycle.

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As mentioned earlier, customer expectations in the public sector must be met in the context of legislative requirements, agency regulations and administration policy. These provide the parameters within which the agency works and may define certain prerequisites for customer acceptance of a product or service. Such prerequisites (e.g., legal standards, timeliness standards) may be translated into quality indicators. Beyond meeting these requirements, however, most agency functions do allow for substantial managerial discretion. This is where customer feedback becomes essential.

Many tools can be employed to find out what customers expect. Common tools are customer surveys, customer focus groups, and customer or user panels. In using customer feedback to monitor quality levels, care should be exercised that survey instruments yield statistically valid results. Additionally, customer expectations change over time (usually increase as services improve); thus, regular, periodic feedback must be obtained.

Agencies may find that different customers of the same output have conflicting or competing expectations. For example, at the Forest Service, customers of the national forests' outputs include timber companies, hunters, hikers, campers, users of recreational facilities, and livestock ranchers. A listing of their expectations quickly reveals that many conflict with each other. Sometimes services provided are extensive and complex enough to allow everyone's needs to be met; however, where choices must be made, the views of all customers should still be sought, choices explained to them, and compromises worked out where possible within policy and legal constraints.

2. Define the entire work process that provides the product/service.

After customers are identified and their expectations are determined, the team developing measures then needs to consider the total work process or program function that produces the agency output. This is important in order to find out if the process enables the agency to fulfill customer expectations.

First, define the function's objective or purpose. Next, identify the first and last steps taken to produce the output in order to determine the parameters of measurement. The total function will most likely, but not necessarily, involve more than one work activity (see worksheet 2, useful for outlining this and the next step). For example, the objective of the system that processes discretionary grants in the DEd is to provide assistance, usually money, to a recipient to accomplish a public purpose of support authorized by Federal statute. The first step in the process is the development, clearance and promulgation of regulations; the final step in the process is the close-out of the grant after its completion. Between the first and last steps, numerous offices and groups are involved in intermediate work activities essential to processing and administering the grants.

3. <u>Define the value-adding activities and outputs that comprise the system.</u>

Identify each step in the system where "value is added" and an *intermediate output* is produced. This step should lead to weeding out steps that do not add value to the process, such as extraneous procedures, non-essential requirements, and time-consuming approval points. Just as customers are identified for the program's final output, identify the customers or users of the intermediate outputs. Next, determine the needs and expectations of each intermediate customer (see worksheet 2). At each step, the quality of the earlier procedures affects the ability to perform the current step with quality.

To continue the discretionary grants example, the six steps below comprise the system for processing grants (more discrete steps exist, but for purposes of simplicity and description, the following are used).

Steps	Output	Customer	Requirements /Expectations
1. Development, clearance and distribution of regulations	Regulations	Sec. of DEd, Office of Gen. Counsel (OGC), OMB	Regulations should: 1) adhere to policy priorities and legislative requirements 2) be clear and consistent 3) cover all necessary areas completely.
2. Development, clearance and distribution of applications	Applications	Grants & Contracts, (GCS) Office of Planning & Budget Eval., OGC	1) standards for inclusion of materials have been met by each office and are consistent with the regulations (preceding step) 2) nothing is conveyed by inclusion,

				implication, or omission that might be a contravention of statute regulation, or departmental priority; 3) supply of applications is adequate to meet needs; 4) applications are distributed in time for grantees to respond.
3.	Formation Review Panel	Review Panel	DEd Program Office	1) readers are specially qualified, 2) there is an adequate number of available volunteer field readers, 3) readers represent enough diverse views and understand regulations and applications (preceding steps)
4.	Review and Ranking of Applications	Selection and Ranking of Applicants	Secretary of DEd, GCS	1) readers are familiar with and understand criteria for review; 2) readers use rating sheets properly and thoroughly, 3) readers consistently apply criteria, 4) field readers communicate well with HQs.

5. Grant Negotiation and Award	Grants Awarded	States, local school districts, public and private education institutions	1) Negotiations are based on consistent application of panel suggestions, departmental priorities, and agency regulations (preceding steps). 2) Amount awarded corresponds to negotiated amount.
6. Grants Administration	Series of monitoring & administrative steps	Grantees	1) Monitoring behavior by DEd is consistent, fair and based on accurate information. 2) DEd is available and responsive during grants monitoring and closeout. 3) Grant close-out is completed within specified time limits.

Each intermediate customer should be adding value to the process of producing the service so that the system as a whole is meeting the final customers' needs.

4. Develop quality measures or indicators.

Each interaction or step indicated above represents a critical point at which value is added to the output for the next user/customer until the final output is produced or delivered. These steps, therefore, become important checkpoints for measuring quality. Consider then, "What should I look at to gauge how well the process is producing intermediate outputs that meet each customer's needs and expectations?" For each step, determine the key deviations that produce problems or variations in meeting customer needs and expectations. Ask the question: "What is the source of that variability?" Answers to these questions indicate why quality is or is not achieved at each critical point. This descriptive information then needs to be quantified by putting it into a ratio format. The example below presents one measure for each step identified previously in the discretionary grants process (see worksheet 3). More measures could be developed for each step.

Step	Key Deviation or Problem	Measure
1. Development, clearance, and promulgation of regulations.	Errors, contradictory statements, confusing language, failure to cover all areas thoroughly	# of Regulations that conform to all requirements _____ Total # of regulations
2. Development, clearance and distribution of applications	Inconsistencies with other DEd or OMB regulations; language in package is not clear and straightforward; standard materials may be missing from packages	# of application packages meeting all requirements _____ Total # of application packages
3. Formation of Review Panel	Availability of qualified readers is limited, a good "mix" for review panels is difficult to arrange	# of qualified field readers available for review panels _____ Total # of readers needed for panels
4. Review and Ranking of Applications	Some readers do not consistently apply criteria; rating materials are not filled out properly	# of rating sheets completed accurately and thoroughly _____ Total # of rating sheets submitted
5. Grant Negotiation and Award	Grantees do not understand basis for award decision or are dissatisfied re: DEd's negotiation approach; award amount differs from negotiated amount	# of Appeals _____ Total # of Awards
6. Grant Administration	Insufficient information on grantee activity is available; monitoring procedures are not carried out consistently	# of complete Progress Reports submitted by Grantees _____ Total # of Grantees

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5. Assess quality measures

To be sure they will be useful, evaluate the measures that are initially proposed using the following criteria (see worksheet 3):

a) Are they formulated at critical points in the total work process, i.e., at steps in the process where value-adding activities produce intermediate and final outputs?

b) Do they encompass a controllable activity? Since the intent is to use this information to verify and make improvements, it is important that the measure is able to reflect any action taken to change the process.

c) Is it feasible to obtain, in a regular manner, the data needed for each measure?

d) Have the users of the measures been identified and their needs incorporated?

e) Have descriptive terms (e.g. thorough, consistent, accurate) been clearly defined?

Nearly all measurement experts advise against trying to construct "perfect" measures. Tom Tuttle, Director of the Maryland Center for Productivity and Quality of Work Life, comments that it is more important to have measures of the right things than it is to strive for precision of the measures. Ellen Rosen, Associate Director of the National Center for Public Productivity, notes that it may be easier to identify and track one quality attribute at first. As a work unit becomes more proficient at defining and monitoring other attributes, these can be added to the measurement system.

EXTENSION OF METHOD 1: USING AN OBJECTIVES MATRIX[2] WITH A GROUP OF QUALITY MEASURES

Once quality measures have been developed using the generic approach described above, it is possible to weight and aggregate these measures into a single quality index, if desired. This technique can be employed to "roll up" a series of measures. If a single overall quality index is used by the organization, it should still be possible to

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[2] This discussion is a modification of the Oregon Objectives Matrix, first introduced by Glenn H. Felix in "Productivity Measurement by Objectives," Oregon Productivity Center Productivity Primer, March, 1983.

assess separately internal quality (affecting customers inside agency) and external quality (affecting final customers). The steps that can be used in developing this type of matrix are explained below and are followed by an example which applies the technique to the Department of Education's discretionary grants process. It may be useful to examine the steps and the example side-by-side.

1. Choose a common scale to be used in charting each measure's result (1 through 10, 1 through 100).

2. For each measure, such as the percentage of grantees that submit financial reports upon close-out, assign the range of possible results to scores on the common scale. With a common scale of 1 through 10, current quality may be assigned a score of 3. Stepped goals or mini-objectives would-be denoted by scores 4 through 10. A quality level which is less than minimally acceptable would be assigned 0. It is necessary to convert actual results to a common scale so that all data are in the same unit and can be added together into one figure.

3. Rank each individual quality measure by its importance relative to the whole composite of measures. Some quality measures may be more important than others because they represent quality attributes particularly significant to customers. Or, if this technique is being applied to the whole work process, it may be that one step plays a greater role in achieving quality than other steps in the work process.

4. Weight each measure according to its rank giving the highest percentage to the most important measure. The sum of all the percentages should equal 100%. Weights can also be assigned with actual numbers, which when totalled, equal 100. Enter the assigned weight in Row C. (see matrix below).

5. (a) Enter the actual data (result achieved in that period) for each measure in Row A and locate the score closest to it in the column below that measure. These are circled in the example. (b) In Row B, write in the common scale score corresponding to this actual score.

6. Multiply the common scale score of each measure by its weight. Do this for each measure and enter in Row D.

7. Sum all of the above products to obtain one quality index for the area that you are measuring with this technique.

OBJECTIVES MATRIX: Discretionary Grants Process
                    ·Step 6: Grants Administration*

Measures:

1. % of grantees that are satisfied with DEd's service (results of periodic survey).

2. % of grantees that regularly submit complete progress reports.

3. % of grantees that do not require site visits by DEd.

4. % of grantees that submit financial reports upon close-out.

5. % of grantees that keep to schedule.

Measures:	1	2	3	4	5		STEP 1 Common Scale
Results:	95	88	82	97	93	A STEP 5A	
Range of Results: (in %) STEP 2	100	100	100	100	100		10
	99.5	98	98	99.5	99.5		9
	99.0	96	96	99.0	99.0		8
	98	94	94	98.5	98		7
	97	92	92	98	97		6
	96	90	90	(97)	96		5
	(95)	(88)	88	96	95		4
	94	85	85	95	94	Current Level of Quality	3
	93	84	(82)	93	(93)		2
	92	83	80	92	91		1
	90	82	75	90	90		0
Common scale score	4	4	2	5	3	B STEP 5B	
Weights (%)	40	20	10	15	15	C STEP 3 & 4	
Score x Weight	1.6	.8	.2	.75	.45	D STEP 6	

Final Quality Index (sum of last row) = 3.8   top score - 10,
                                    STEP 7   current level, if
                                                 scores in row 3 - 3.0

*Please note that these measures, scores and weights are hypothetical.

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METHOD 2: USING QUESTIONNAIRES AND CHECKLISTS TO ESTABLISH A QUALITY INDEX

Instead of setting up individual measures that reflect levels of possible deviation at critical points in the process, it is also possible to set up a structure for measuring quality by identifying significant areas of activity in a particular function. The following approach was applied by Charles J. Ferderber of Deaconess Hospital Inc. of Evansville, Indiana. The example used applies to the Pharmacy Department.

1. Determine the significant areas of activity where quality is important to customers (these may be determined by legal or regulatory requirements as well as customer feedback). Within the Pharmacy Department these are: procedures, service, records, equipment maintenance, bacteriological measurements, public relations, and the physical environment.

2. Ask the question: "What do I look at in each area to gauge how well the process meets customer needs or expectations?" With this information, formulate a series of questions in each area that require a YES or NO answer. Sources for questions could be regulations or policy requirements, standards used by an appropriate accreditation board, a supervisor's or manager's expectations, and customer feedback. For example, two questions from each area in the Pharmacy Department (although numerous questions were used) are listed below:

Procedural Area

Are up-to-date pharmaceutical reference materials provided?
Is expiration log reviewed on a monthly basis?

Service Area

Does adequate communication of new product information to nursing service and other hospital personnel exist?
Is the confidentiality of patient/medical staff information maintained?

Records Area

Are outpatient profiles routinely scrutinized by a pharmacist?
Are IV drug record cards filled completely and properly?

Equipment Maintenance Area

Are work orders initiated to document maintenance and repair requests?

Is there a written plan defining the inspection interval for each individual item or category of equipment?

Bacteriological Measures Area

Is microbiological monitoring done as required by the Infection Control Commission?
Are the neck ampules of IVs wiped with 75% alcohol before breaking?

Safety Area

Are personnel on all shifts fully aware of fire drill procedures?
Are there written procedures that specify the action to be taken during the failure of essential equipment and major utility services?

3. Have a trained person (or supervisor) observe or check each activity on a random basis several times during the year and respond to each question with a yes or no response. Calculate the percentage satisfactory responses (yes) in each area to yield a raw score. This step is completed below for the service area of the Pharmacy Department.

	Observation Results	
	YES	NO

Services Area

1. Is a messenger and delivery service provided? X

2. Are outpatients instructed by a registered pharmacist upon receiving prescriptions? X

3. Is there a system designed to assure identification of ambulatory care patients at the time they receive prescribed medication? X

4. Does communication of new product information to nursing service and other hospital personnel exist? ... X

5. Is the confidentiality of patient/medical staff information maintained? X

6. Does this department cooperate in the teaching and research programs of the hospital? X

7. Are instructions given to the patient or the appropriate nursing department/service personnel who advise the patient, verbally or in writing, concerning the importance and correct use of self-administered medications to be taken following discharge? X

TOTAL 6 1

Raw Score (Total Yes/Cumulative Total = 6/7) 85.7%
(STEP 3)

Relative Value (determined by some agreed-upon criteria) (STEP 4) 30.0%

Quality Index (Raw Score x Relative Value =.857x.30) (STEP 5) 25.7%

4. Rank each area of activity by its importance relative to the other areas. This is done using some agreed-upon criteria --it may be that one area, such as service or bacteriological, clearly adds greater value to the final product than another. Weight these areas appropriately by assigning a percentage figure which reflects their relative value. Weights should add up to 100%. For example, the service area may be assigned 30% to represent the significance of external service quality to the customers. The bacteriological measurements area might be assigned 20% and the other five areas would be assigned percentages from the remaining 50% for a final sum of 100% (see inclusion of service area's relative value above).

5. Multiply the raw score by the relative value of each area to arrive at a quality index for each area of activity (see example above).

6. Add together all area indexes to get one total quality index. This figure will be a percentage indicating quality achieved by the function (or in this case, an organizational unit) out of a possible 100% score. While this step allows a net aggregate quality index to be calculated, it is important to evaluate the quality indexes for each area. These indexes give information about critical points in the total process and point to areas in need of improvement.

PHARMACY DEPARTMENT

Areas	Raw Score	Relative Value		Quality Index
1. Procedures	83.3%	x	10%	8.3%
2. Service	85.7%	x	30%	25.7%
3. Records	77.8%	x	10%	7.8%
4. Equip. Maint.	40.0%	x	10%	4.0%
5. Bact. Measures	100%	x	20%	20.0%
6. Public Rel	91.4%	x	10%	9.2%
7. Physical Environment	85.1%	x	10%	8.5%
Total			100%	83.5%

(Since two percentage figures are multiplied together to arrive at the area quality indexes and then rounded off to one decimal place, the total quality index of 83.5% is an approximate figure).

METHOD 3: DETERMINING THE COSTS OF QUALITY FAILURE

Another way of measuring quality is to determine what the total cost of quality failure is and to work to drive those costs down to zero. Quality failures have both internal and external dimensions. Failures may occur in work processes (internal) or in the products and services delivered to customers (external).

1) Internal failure quality costs

These are the costs associated with defective products, components, materials, documents, equipment, information and services that fail to meet quality requirements before reaching the agency's customer. The total dollar amounts associated with internal failure quality costs must be tracked and calculated on a wide variety of items where failures occur. For example:
   - Redoing proposals before submittal to customer.
   - Attending internal quality problem meetings.
   - Delays and searches for missing or incomplete information.
   - Document recycles to correct errors.
   - Inactive inventory write-offs.
   - Interest impact of delayed invoicing.
   - Carrying costs of excess inventory.
   - Meeting with and trips to vendors as a result of quality problems.
   - Redesigning due to mistakes or problems.
   - Reworking software programs and manuals.
   - Rework of any type.
   - Scrap.
   - Reinspection and retest.

2) External failure quality costs

These are the costs associated with defective products, components, materials, documents, equipment, information and services that fail to meet quality requirements after reaching the agency's customer. The total dollar amounts associated with external failure quality costs must be tracked and calculated on a wide variety of items where failures occur. For example:
   - Redoing proposals after submittal to the customer.
   - Attending quality problem meetings with the customer.
   - Processing and responding to customer complaints.
   - Policy concessions related to quality problems.
   - Interest impact of overdue and suspense accounts receivable.
   - Field rework not billable.
   - The value of customer deducts and claims and related administrative efforts.

Measuring the cost of quality failures from the first step of the work process across the entire function to the ultimate service delivery to the customer may be a startling experience for a manager. Private sector companies that have done this have found that those failure costs can amount to as much as 25 to 30 percent of their total budgets. Focusing on failure cost categories gives managers the opportunity to direct their quality improvements where they will accomplish the most good.

Obtaining the specific costs of white collar rework or lost time is sometimes difficult, but relatively simple estimating techniques can be employed as long as there is consistency from period to period. Westinghouse Corporation has been collecting and reporting quality failure costs for several years. The elements they use for sales, direct product costs, managed costs, non-division costs and other costs together with checklists for marketing, engineering, purchasing, manufacturing, quality assurance, management systems, human resources, controller, and service functions are included in the Appendices. Many of the elements and items used by Westinghouse are directly applicable to several agency functions. More importantly, the methodology of measuring quality failure costs can be adapted to fit the types of work carried out by any agency.

The development of cost elements can follow the same step-by-step procedures as explained in the generic methodology, beginning with identifying customers and their requirements for each step in the process. The major difference is that the measures that flow from the key deviations (see pp. 17-18) will be in costs of failure ($) rather than in a ratio format.

SUMMARY

The techniques reviewed in this paper address the subject of quality measurement -- what quality is and how it can be measured -- for the purpose of improving services to customers. The first method, the generic approach, looks sequentially across the work process, that is, at the series of steps resulting in the final output. The second method, the use of checklists, focuses on the whole organizational system that produces the output. The third method combines the sequential process with the use of checklists but changes the number or percent of quality failures to an actual dollar or cost figure. All three approaches are valuable because critical points are identified for measurement, and consequently for improvement. All methods rely on meeting requirements and customer expectations as their starting point.

The method that is ultimately selected for use will depend on several factors: applicability to type of work process, presence or absence of checklists/cost data, ease of use, etc. Regardless of which approach proves more useful, quality measures should

be developed that address both service quality to customers and process quality of internal work processes. These measures should also address behavioral dimensions of quality and non-routine aspects of quality.

The methods presented in this paper have a wide range of application. They can essentially be used with any program function or work process that can be broken down into its parts or components. The other condition that should be present is that some judgment can be made and quantified regarding quality levels achieved. Nearly every function in the governmentwide Quality and Productivity Improvement Program meets these two conditions. To help agencies develop and use quality measures in their everyday management of programs, worksheets are provided in the Attachments and examples of quality measures formulated with the techniques outlined in this paper are included in the Appendices.

Finally, once quality measures are developed, managers should evaluate them by the degree to which they are:

- Related to requirements and customer expectations
- Practical to implement
- Easy to understand
- Able to drive desired behavior
- Developed with inputs from and consensus with work groups
- Specific

(This paper has been prepared by staff of the Federal Quality and Productivity Improvement Program in the Office of Management and Budget (OMB). If you wish additional information on or assistance in developing quality measures, contact Carolyn Burstein, Chief, Productivity Management Branch (202 - 395-3692). Sources of additional information as well as contacts in other Federal agencies can be identified for you.

(Characteristics of a High Quality Service (with respondents' comments)

Determine Quality By . . .	All Consumers 1985 %	All Consumers 1988 %
Courteous/polite treatment: The way they treat you—being courteous; polite; manners; politeness; courtesy; if the people are nice to you; how well they treat you.	21	21
Satisfy your needs: Meets your needs; by the service I get; if you get what you come in for; that the service well meets my needs and provides what I require in satisfaction; do what they are supposed to.	18	13
Past experience/Trial & error: Just experience with them; just go and you get a service and see if I like it. Quality of service from former experience; you can't judge it until you've tried it; by flying on the airlines; trying them.	13	6
Recommendations/Word of mouth: People talking about them—word of mouth; just hearing people talk; I suppose probably by someone else recommending it; what people say.	12	8
Promptness: Prompt attention to problems; by how long it takes to get it fixed; I don't have to wait; timeliness; how fast they are; quick service.	12	15
Price: If the services are cheaper; price compared to services given; low in price; getting what you paid for; give you good deals; one I can afford.	11	7
Attitude of personnel: The attitude of the personnel helping me; good personality; the personality of the people running it; attitudes.	10	12
Helpful personnel: How helpful people are; helpfulness; willing to help; cooperation of employees.	9	8
Friendliness: Friendly service, I look for friendly people; people are nice.	8	8
Reputation: Well established reputation; on their reputation.	7	5
Advertising: See what they advertise; I would be influenced to some degree by ads; advertisements.	6	3
Personal attention: Need more personal attention; excellent concern for you personally; the personal service; attention to customers; personal touch.	6	5
Cleanliness: Cleanliness of place of business; cleanliness is important; the place is clean.	6	7
Availability: Availability of services.	4	3
Services are good: It seems to be OK; must be pretty good.	4	6
Efficiency: Efficiency of staff.	4	8
Trouble free: No hassle; no mistakes; keeping things correct; just as long as they don't screw up my account or anything like that; no goof ups.	4	1
Convenience: The convenience in using them.	3	2
Dependability: Reliable; if they are reliable; somebody to depend on and trust.	3	6
Company name: Brands; by the names; name of company; probably on a name brand basis like airlines.	2	1
Variety of services: The variety.	2	2
Accuracy: Accuracy of bank statements and credit statements; accuracy of accounting.	2	2
Length of time in business: How long it had been established; by their years in business.	*	*
Miscellaneous	4	2
Don't know	8	13
Total	179**	164**
Number of Interviews	(1005)	(1005)

*Less than one-half of one percent
**Total exceeds 100% due to multiple response.

2

National Productivity Report

THE NOMINAL GROUP TECHNIQUE OF PROBLEM SOLVING

One of the more effective group problem solving tools, the Nominal Group Technique (NGT), involves from 6-10 employees. It is effective in: identifying solutions; identifying problems; setting priorities. Typical nominal questions might be, *"What blockages prevent formation of more Quality Circles?"* *"What steps should Dept. 45 take to improve productivity?"* *"How can we measure the results from the improvement effort?"*

In NGT a group of employees is asked to supply the best answers to a given problem; the most important answers are determined by vote and ranked in numerical order. There is total participation by all employees, the environment is relaxed, non-threatening, free from leader bias, knowledge is shared and creativity is stimulated. Employees share in the ownership of the solutions and will work to implement change as well as convince others.

Four Steps in the Nominal Group Technique for Problem Solving

1. Ideas are generated in silence before being written down by participants.

2. Round-robin feedback of ideas and recording.

3. Each idea is discussed for full clarification and understanding.

4. Ideas are voted on and ranked.

Select a meeting room with plenty of wall space. A leader is assigned who acts as recorder and guide. He remains impartial and is not chosen from the group. Have a flip chart, masking tape, broad-tipped felt pen, 3 x 5 cards, sheets of paper with the question written across the top of each sheet. Each participant gets a sheet of paper with the question on it.

1. <u>Silent generation of ideas and writing</u>. Members reflect on the question and begin writing their solutions on the sheet handed them. Answers should be short, to the point. Talking to neighbors is a no-no. After about five minues leader calls a halt.

2. <u>Round-robin discussion and recording.</u> Leader goes around the table soliciting one idea from each member. He writes the idea on the flip chart in front of the entire group numbering each idea starting with number 1. The next person is asked and his idea is jotted down, number 2. If one person has the same idea as one already recorded he may "pass" and reenter with another idea during the next round. As leader fills each flip sheet it is torn off and taped on the wall. Leader should retain member's original words, but with the member's help abbreviated or condensed. Duplicate ideas are avoided. Do not debate slightly similar ideas. If there are differences write the ideas down. This list becomes the guide for further discussion.

3. <u>Discussion for clarification and understanding:</u> After all ideas have been solicited and numbered and written down on flip sheets the leader reads each idea out loud starting with number one. Group is asked if they understand the idea to avoid misunderstanding. Person who submitted the idea will generally explain it. No debate on the merit of the idea. No long discussions. Leader must

Preceding page blank

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pace the discussion to prevent it from getting stuck on one idea. Prevent single participants from taking to the soapbox in defense of their idea.

4. Voting and ranking of ideas: Assume there are 18 ideas on the flip sheets. Members will be asked to select the five best. (Generally, with 18 items members will select seven; for our purpose let's stick with five.) Studies show that participants can rank seven items ($\pm$ 2) with some reliability of judgment. With shorter lists five is sufficient. The leader hands out five 3 x 5 cards to each participant. As he explains the procedure he draws a 3 x 5 card on the flip chart. Voting is critical, confusion results if instructions are not followed.

Each member spreads his five cards in front of him and is asked to write down the five best ideas, one idea to a card. The number attached to the idea on the flip sheets must accompany the ideas as they're written down. These numbers are written in the upper left hand of the 3 x 5 cards. Members now study the five cards and five ideas they have selected.

The next step ranks the ideas. Members are asked to select the best of the five ideas they've written down by placing a 5 in the lower right hand corner of the card and underlining it three times. This avoids mix-up of numbers. They turn that card face down and select from the remaining four cards the least important idea and mark it with a 1, also underlining it three times. Then the next best idea is selected and marked with a 4; then the least important is marked with 2. The remaining card gets a 3.

Leader collects the cards, shuffles them. On the flip chart he lists the 18 numbers vertically, representing the 18 ideas. The idea rating number which is underlined three times is transferred to the flip chart opposite the idea number. For example: he picks up a card with number 11 marked in upper left hand corner, in the bottom right hand corner is a 5. He places number 5 opposite number 4 on the flip chart, continuing through all the cards. See example:

By adding the numbers horizontally across we find that number 4 is considered the best; other ideas, in order of best, are 15,2,10,13. Here we listed only eight ideas out of 18 on the flip sheets due to lack of space. In practice some ideas will never get a mention and some will receive only 1s.

Idea number	Rank
2	4-3-5-3-3
4	5-5-4-3-5
5	3-4-
7	2-3-1-
8	1-
10	4-5-3-2-3
13	3-4-2-2-1
15	4-5-3-5-2

Some practitioners like to have a clarification discussion at this point to make sure all participants fully understand the five best ideas, and then take another vote. Generally the rankings do not change after this additional step. If there are as many as 20 participants it is best to divide them into three groups, with final cumulative voting by all groups on all the best ideas, thus getting a super-duper best.

* * * *

Function:_____

List answers to the following questions in the chart below.

For each final output in the function, consider:

<u>Who are my customers</u>?

<u>What are their requirements and expectations</u>?

FINAL OUTPUTS	CUSTOMERS	REQUIREMENTS AND EXPECTATIONS

Define the System

Function:_____

Objective:_____

_____

First Step:_____

_____

Last Step:_____

_____

(Intermediate steps will be listed below)

2. For each step or value-adding activity in the process that produces the product/service, list the output (intermediate or final), customers, and customers' requirements and expectations.

STEP	OUTPUT	CUSTOMERS	REQUIREMENTS AND EXPECTATIONS

WORKSHEET 2a

Function:_____

STEP	OUTPUT	CUSTOMERS	REQUIREMENTS AND EXPECTATIONS

Function:_____

1. For each step, identify the key deviations that produce problems in meeting the customers' requirements and expectations listed above. Put the source of variation in meeting those requirements and expectations into a ratio format, this creates a measure. Finally, evaluate the measure with a doublecheck against the criteria noted in step 5.

STEPS	KEY DEVIATIONS OR PROBLEMS	MEASURES	ASSESS

APPENDICES

SELECTED EXAMPLES OF QUALITY MEASURES USED IN PRIVATE-SECTOR COMPANIES AND IN PUBLIC-SECTOR AGENCIES

	Element
Sales	**Sales concessions** The amount of any reduction in selling price because of failure to meet customer requirements.
	Returned goods Costs of products returned because of failure to meet customer requirements
Direct Product Costs	**Premium transportation** Costs for more expensive transportation because of failure to meet requirements with standard transportation.
	Shipping errors Costs resulting from errors in shipment - wrong quantities, wrong routing, wrong carrier, etc.
	Penalties Costs incurred for payment of penalties for failure to perform in accordance with contract requirements - including late delivery performance and reliability (include costs not covered by warranty or business policy concession).
	Operator efficiency variance Total costs of productive employes not meeting the net allowed standard. (Average negative variance/hour multiplied by total net allowed hours multiplied by direct labor rate plus benefits.)
	Field deficiency cost The costs incurred as a result of non-conformances found at customer sites prior to start-up and/or the beginning of product warranty.
	Scrap Scrap due to manufacturing non-conformances including operator errors, carelessness, breakage, etc. Include scrap due to design, ordering errors, purchased material, tooling problems, etc. Make sure scrap costs include material costs, labor costs and benefits.
	Supplier overtime Additional costs paid to suppliers and subcontractors because of our request to change or complete the work on a different schedule.

*Direct costs resulting from things not being right the first time.

3

	Element
Direct Product Costs	**Vendor costs for change** For purchase orders on which we issue a change notice because we failed to supply correct and total information, the additional price charged by the vendor is a failure cost.
	Subcontract premium Costs incurred above normal in-house cost on product or service normally performed in-house but being subcontracted because of failure to perform to requirements in-house.
	Demurrage The amount paid for detention of railroad cars, trucks or boats for loading or unloading beyond a scheduled time. The amount paid for detention of containers beyond the scheduled return date.
	Special trouble reserve accounts Charges to accounts set up to accumulate costs on special or high cost problems. Normally are specially established for each problem.
	Waiting time Total cost of productive employes doing non-productive/miscellaneous work (include benefits).
	Rerouted work variance Cost of performing work on less efficient machines.
	Blue collar rework Include *all* rework, not just the amount reported in the accounting reports. Typically, only a fraction of the true rework costs are reported. Sample your people. Ask them what percentage of their time is spent doing work a second, thire or fourth time because something was not right the first time. Cost using direct labor and benefits.
	Other losses Shop losses due to non-conformances other than defective workmanship such as: materials ordered incorrectly, replacement of lost material, and errors of expense employes.
	Defective purchased material Losses due to defective materials and parts either purchased from vendors or received from another Westinghouse division or site.

III

	Element
Direct Product Costs	**Equipment repair costs due to failure to do preventive maintenance** Equipment repair costs incurred because planned preventive maintenance was not performed as required, or because no preventive maintenance has been planned, even though it should have been. **COD - Shop** Costs for tooling changes made necessary because of problems or design changes. **Rework and lost time on engineering contracts** Rework and lost time related to billable engineering and service. See checklist for the service and engineering functions for the kinds of things to include. **Warranty** The total cost involved in correcting non-conformances on products still in warranty. Use actual warranty, not the accrual. Make sure warranty picks up all costs of poor quality in the field. Sometimes field costs are reported to other accounts. Add the costs of service and administrative people who may not be charged to the warranty account, but who are doing work associated with warranty. **Rework on billable software or other work for which cost appears in this category** Rework and lost time related to billable software or other work. See checklist for the Management Systems and Engineering functions for the kinds of things to include.
Managed Costs	**Inactive/obsolete inventory (Balance sheet cost)** This is the value of inventory which has been scrapped via write offs to the inactive/obsolete inventory reserve account (12931) during the year. It may include:

- Inventory items which have had no issues for a time period longer than the time period assigned to that class of inventory. In most cases, this time period is one year.
- Work in process inventory assigned to closed orders which cannot be used on other open orders.
- Inventory identified only to obsolete designs regardless of the time period since last issue.
- That portion of surplus inventories which exceeds a reasonable estimate of the total requirements for the remaining life of the applicable product lines, including spare parts requirements.
- Also include the cost of reworking inactive inventory to make it saleable.

Element

Managed Costs

Business policy concessions
Costs of sales discounts, extended warranties, service work or products given because of quality or performance issues.

Cost of department errors
Losses resulting from department mistakes.

Travel for non-conformance...
The costs of travel that is done to address non-conformance situations at vendors, subcontractors, customer sites, etc.

Overtime bonus
The total cost of overtime bonus paid for work that is performed as a result of non-conformance - blue collar and white collar.

Lost time - white collar
Time of white collar employes (including managers) lost because something was not done right the first time. See checklists for each function for specific kinds of things to include.

Cost using direct labor plus benefits.

Checklists available for the following functions:

Marketing
Engineering
Purchasing
Manufacturing
Quality Assurance
Management Systems
Human Resources
Controller
Service

Strategic projects
Costs of all strategic and R&D projects directed primarily at correcting a product or service deficiency.

Non-Division Costs

Comprehensive general liability costs
All costs resulting from non-conformance situations including lawyer costs, records, court costs, liability and payments.

V

Other Costs

Interest lost on uncollected receivables (Balance sheet cost)
The average suspense account balance and overdue receivables related to quality problems multiplied by the appropriate cost of money.

Interest lost on invoicing delays (Balance sheet cost)
The amount of lost revenue due to delays in invoicing sales. Calculation: sales value multiplied by the cost of money (per day) multiplied by the average number of days invoices are delayed.

Excess inventory carrying costs (Balance sheet cost)
This is the value of surplus inventory which has not yet been written off to the inactive/obsolete reserve account (12931) times an estimate of annual carrying costs.

Surplus inventory is defined as the portion of total inventories which exceed maximum allowable balances necessary to satisfy currently defined operating requirements.

Carrying costs include the cost of money, obsolescence, deterioration, taxes, insurance, storage, and management costs. They typically range from 25 to 35 percent of inventory in this category per year.

Element

Sales

Lost margin on lost orders
Ask your marketing people to estimate how much business was lost in the measurement period because customers bought from another company, because they were not satisfied with Westinghouse quality. The lost margin on that business is a failure cost.

Direct Product Costs

Purchase resale variance
The costs incurred because purchase resale items cost more than the estimated price used in the contract agreement.

Committed Costs

Depreciation and lease cost on facilities used for rework
Costs associated with that portion of facilities used for rework. Include floor space and equipment which would not be needed if task were performed right the first time.

**Sales and
Direct Product Costs**

Delayed billings and resulting interest impact (Balance sheet cost)
How many dollars of billings and resulting margin do you lose each month because product is rejected and does not ship? How much extra billing and margin could you generate if employes were not reworking product, but were making additional products? Estimate as billing value times the margin over direct product costs percentage times the cost of money for the period delayed.

All Categories

Cash impact (Balance sheet cost)
For elements not already assessed interest impact, estimate the cash impact of tying up corporate funds for these activities, as opposed to investing these dollars and earning interest on them. The impact is the total cost times the cost of money.

*Indirect costs resulting from things not being done right the first time.

The following checklists provide examples of numerous profit detractors resulting from things not being done right the first time. These listings are sorted by functional area and can be used as guides in the development of measurements of failure cost activities.

Many Westinghouse divisions refer to costs estimated by using these functional checklists as "calculated" costs.

Marketing

- Revisits to customers - original call not well planned.
- Revising proposals and quotations - errors or omissions.
- Correcting price lists, spare part lists, sales literature and other software.
- Redefining order requirements after order is entered.
- Clarifying or correcting errors in internal orders.
- Administration of product returns, warranty, claims and customer complaints.
- Investigation of field problems.
- Answering customers on problems and complaints, and getting satisfactory problem resolution.
- Resolving billing problems.
- Rescheduling jobs because of Westinghouse problems.
- Getting deviations approved by customers.
- Attending "quality problem" meetings.
- Revising inaccurate market forecasts.

- Explaining schedule delays to customers.
- Recovering lost customer confidence because of past problems.
- Product liability defense.

Engineering

- Clarifying order or customer requirements.
- Correcting design errors.
- Correcting and revising design procedures.
- Preparing and processing change notices due to Westinghouse problems.
- Changing drawings and specifications.
- Investigating and solving shop problems.
- Investigating and solving field problems.
- Rescheduling and revising project plans because of delays, poor forecasts, late parts and materials.
- Waiting because of equipment downtime or late information.
- Investigating and solving supplier problems.
- Processing requests for deviations from requirements.
- Product liability defense.

Purchasing

- Getting clarification or correction of drawings and specificaitons.
- Correcting requisition errors.
- Correcting purchase order errors.
- Expediting and rescheduling.
- Processing rejection paperwork.
- Processing deviation requests.
- Dealing with suppliers on quality problems.
- Correcting invoicing and payment errors.
- Processing change notices not customer caused.
- Recovery costs associated with non-conforming material.
- Waiting because of equipment downtime.
- Dealing with claims for handling or carrier damage.
- Investigating and resolving shop and field problems.
- Travel because of non-conformance.
- Approving invoices related to unpriced purchase orders.

4-1

Manufacturing

- Clarifying and interpreting engineering requirements.
- Expediting and rescheduling.
- Correcting errors in manufacturing information, orders, specifications and drawings.
- Implementing changes not customer caused.
- Reporting reasons for problem and delays.
- Dealing with missing or non-conforming material.
- Handling, documenting and reworking non-conforming work.
- Requesting deviations.
- Retesting.
- Meetings to repeatedly review problems, details, overdues, etc., without correction of causes.
- Waiting because equipment is down.
- Rescheduling because of poor forecasts.
- Rework and rescheduling because of design errors.
- Correcting poor workmanship.
- Investigating and correcting field problems.
- Processing rejected material forms.
- Rework and lost time because of inadequate equipment capability.
- Correcting handling damage.
- Rework because of poor training or instructions.
- Correcting inaccurate reports.
- Processing extra work slips/ reordering replacements for scrapped parts.
- Repairing equipment because of failure to do preventive maintenance.

Quality Assurance

- Evaluating/dispositioning discrepant material.
- "Firefighting" problems.
- Issuing defect reports.
- Attending "quality problem" meetings.
- Investigating factory/field failures.
- Administering warranty program.
- Problem solving with vendors.
- Monitoring/implementing corrective action.
- Issuing/analyzing defective apparatus tags.
- Retraining inspectors/ operators.
- Utilizing overtime.
- Reissuing incorrect reports/ data.
- Sorting questionable material.
- Correcting quality documentation (procedures, specifications).
- Investigating test failures.
- Performing failure analysis.
- Tracing/purging discrepant material.
- Maintaining quality cost data.
- Entering failure data (into data collection systems).
- Determining failure responsibility (allocating charges).

Management Systems

- Clarifying or correcting user requirements.
- Investigating and correcting inadequate service levels.
- Rescheduling and expediting work because of inadequate planning.
- Redefining and redirecting projects because of inadequate project definition.
- Correcting problems caused by inadequately trained people.
- Correcting results of inadequate data back-up and recovery procedures.
- Investigating and correcting operational problems and "customer" complaints.
- Waiting because equipment is down.
- Debugging operational programs and systems.
- Redoing work because of a lack of a standard system for programming documentation and records.
- Correcting data base because of user errors.
- Dealing with problems caused by inadequate long-range systems planning.
- Investigating and correcting supplier (contract planning, time sharing, consultant) caused problems.
- Rerunning jobs because of problems.

Human Resources

- Increasing or decreasing workforce because of poor forecasts.
- Correcting the results of poor, inaccurate, or incomplete communications.
- Correcting the results of poor or inadequate training.
- Dealing with problems caused by poor supervision.
- Correcting errors in salary administration.
- Correcting errors in administration of benefits.
- Correcting errors in reports and records.

Controller

- Investigating and correcting billing problems.
- Investigating and correcting problems with payments to suppliers.
- Investigating problems or errors on expense reports.
- Revising forecasts because of delays, errors, test failures.
- Investigating and correcting variances in inventories.
- Processing engineering changes due to internal problems.
- Processing scrap tags, salvage sheets, excess labor authorizations.
- Waiting because equipment is down.
- Processing warranty claims, sales concessions, customer deducts.
- Correcting reports, forecasts, statements because of errors.

Service

- False starts - lack of information or materials.
- Correction of non-conformances.
- Waiting.
- Resolving billing problems.
- Obtaining complete information.
- Resolving interpretation questions.
- Travel for non-conformance.
- Meetings to discuss and resolve problems.

4

A. Quality failure costs - "hard" elements

Elements	Amount
Sales concessions	_____
Returned goods	_____
Premium transportation	_____
Shipping errors	_____
Penalties	_____
Operator efficiency variance	_____
Field deficiency cost	_____
Scrap	_____
Supplier overtime	_____
Vendor costs for change	_____
Subcontract premium	_____
Demurrage	_____
Special trouble reserve accounts	_____
Waiting time	_____
Rerouted work variance	_____
Blue collar rework	_____
Other losses	_____
Defective purchased material	_____
Equipment repair costs	_____
COD - Shop (tooling changes)	_____
Rework/lost time - engineering contracts	_____
Warranty	_____
Rework - billable software	_____
Inactive/obsolete inventory	_____
Business policy concessions	_____
Cost of department errors	_____
Travel for non-conformance	_____
Overtime bonus	_____
Lost time - white collar	_____
Strategic projects	_____
Comprehensive general liability costs	_____
Interest lost - uncollected receivables	_____
Interest lost - invoicing delays	_____
Excess inventory carrying costs	_____
Total	_____

B. Quality failure costs - "soft" elements

Element	Amount
Lost margin - lost orders	_____
Purchase resale variance	_____
Depreciation/lease cost - facilities used for rework	_____
Delayed billings - resulting interest impact	_____
Cash impact	_____
Total	_____

B. 3 M CORPORATION

1) % complaints due to defective product
2) % complaints due to dissatisfaction with service
3) % order entry errors
4) % shipping errors
5) % administrative errors
6) % availability of requested information
7) % delivery on time
8) % rework (across all internal functions)
9) % lost time due to accidents
10) % incoming materials conforming to specs...

C. CIGNA HEALTH PLANS

Customer surveys are taken periodically that cover three areas of service:

a) Accessibility: waiting time to get an appointment; waiting time for a phone to be answered, etc.

b) Communications: effectiveness of communications with receptionists, nurses, physicians, and pharmacists

c) Administration: time for a claim to be paid; accuracy of the bills.

Quality Standards have been established in several areas. They include: certification and levels of expertise of personnel; promptness by doctors in returning messages; patients receive results of diagnostic tests within scheduled period of time (depending on type of test); each physician available for appointments within reasonable period of time; patients wait no longer than 15 minutes for non-emergency and 10 minutes if urgent.

D. FIRST NATIONAL BANK OF CHICAGO

% checks not properly read by check processing equipment
% check encoding accuracy of single and multiple deposit items
% accuracy of returned checks
% checks deposited information posted on time to customers'accounts
Coin and currency error ratio per million bills processed

% customer inquiry resolution closed within stated time-frames

Accurate and timely processing of customer adjustments and response to inquiries on a scale of one-to-four

Customers rank of the level of knowledge, courtesy and responsiveness displayed in handling their inquiries

% accuracy of all customer initiated purchase and sale transactions delivered against payment

% accurate processing of stock dividends, stock splits, bond calls and corporate reorganizations in customers' portfolio

% response to customer requests for information within 24 hours

Accuracy in certifying pools of mortgages for GNMA and FNMA issuers

% collateral status changes made same day of receipt

% commercial paper issued accurately

% commercial paper paid accurately

% exchange items processed within five days

% public securities transferred and reissued within 72 hours of receipt

% routine transfer of stock certificates completed within 72 hours

% availability of on-line money transfer service

% availability account statements to global account customers by 9:00 AM E.S.T.

% errors per thousand transactions in processing transactions

% timely processing of incoming Fed wires

E. HONEYWELL AEROSPACE AND DEFENSE

$$\frac{\text{\# units accepted}}{\text{units inspected}}$$

$$\frac{\text{cost of quality}}{\text{cost of sales}}$$

$$\frac{\text{\# units scheduled}}{\text{\# units produced}}$$

$$\frac{\text{\# delinquent units x selling price}}{\text{average daily sales}}$$

$$\frac{\text{\# customer - accepted lots}}{\text{\# lots submitted}}$$

$$\frac{\text{\# defects}}{\text{\# units inspected}}$$

$$\frac{\text{\# hrs. on rejected engineering reports}}{\text{total hours reported}}$$

$$\frac{\text{\# hrs. on labor ticket rejects}}{\text{total hours reported}}$$

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$$\frac{\text{\# project overruns \$}}{\text{total project \$}}$$

$$\frac{\text{\# key performance specs. met}}{\text{total no. key performance specs.}}$$

$$\frac{\text{\$ delinquent deliveries}}{\text{average daily sales}}$$

$$\frac{\text{hardware up-time}}{\text{total hardware time}}$$

$$\frac{\text{out-of-service terminals}}{\text{total no. terminals}}$$

$$\frac{\text{\# trouble calls received}}{\text{unit of time (week, mo., etc.)}}$$

$$\frac{\text{\# user complaints}}{\text{\# hrs. equipment usage}}$$

$$\frac{\text{\# errors on procedures}}{\text{\# total procedures issued}}$$

$$\frac{\text{\# errors in data collection}}{\text{volume of data collected}}$$

$$\frac{\text{\# purchase order errors}}{\text{purchase orders audited}}$$

$$\frac{\text{\# viewgraphs redone}}{\text{viewgraphs produced}}$$

$$\frac{\text{cost of viewgraph changes}}{\text{total graphics cost}}$$

$$\frac{\text{\# backlog hrs. on maintenance work orders}}{\text{\# total maintenance count}}$$

$$\frac{\text{\# invoicing errors}}{\text{\# invoices processed}}$$

$$\frac{\text{non-productive time}}{\text{total time available}}$$

F. XEROX CORPORATION

Examples in Customer Service area:

a) % service calls responded to within 4 hrs.; within 4-8 hrs.; over 8 hours.

b) % of times machine is repaired on the first time (e.g., lack of a part causes a return call)

c) % availability of equipment (standards: low to mid-volume machine 98% up-time; high volume machine 96% up-time)

d) % "faultless" installation of machine (on-time delivery; wiring and space adequately prepared; etc.)

e) % reported problems resolved correctly the first time (standard: 95%)

f) % billing accuracy (standard: 98%)

Xerox has similar measures for order entry, billing and collection activities, as well as for sales, product development, manufacturing, and internal services (e.g., computer services, in-house printing, etc).

EXAMPLES OF QUALITY MEASURES USED IN PUBLIC-SECTOR AGENCIES

A. TRAINING

% students completing course
% student evaluations in highest category
% accrediting organization evaluations in highest category Proficiency scale in subject matter
Time period to gain proficiency
% student and agency supervisor evaluations in highest category (post hoc evaluation)

B. COMPLAINT RESOLUTION

\# improvements in service (e.g. providing consent form in Spanish)

% cases offered early resolution
% cases amenable to early resolution

% cases resolved through early resolution
% cases offered early resolution

$ recovered through early resolution
$ at issue

\# field offices using quality control on early resolution cases
\# iterations a document undergoes before it is acceptable
% complete information on case status in tracking system
% complainants who perceive lack of fairness in resolution process

C. INVENTORY MANAGEMENT AND PURCHASING

% purchased parts with alternate sourcing
% critical parts single sourced
% price quotes on which price breaks are offered
% newly qualified vendors
% "out-of-stock" incidents per certain period in warehouse
% advantageous price breaks taken
% vendor acknowledgements received which match purchase order
   items
% vendor shipments over or under quantity ordered
% vendor invoices containing errors
% total inventory considered obsolete
# and quantity of inventory adjustments
# stock units not properly rotated
% accuracy of inventory locator system
% shelf-life spoilage

D. MAINTENANCE

Defects generated per unit of equipment or per production hour

% maintenance work that is repeat work or call backs
% equipment downtime due to maintenance failure

completion on schedule
#scheduled completions

E. LICENSING

% accuracy of information entered in data base by data entry personnel
% consistency rate in the way applications of a similar nature are processed and
   decisions reached
calls received from applicants regarding status of application (objective: reduce
   calls by improving timeliness and up-front information provided applicants)
% errors in licenses requiring recall or cancellation
% applications achieving data entry same day as receipt of application
# days between receipt of application and final closeout
% applications not processed within statutory time frames

F. FINANCE AND ACCOUNTING

% accuracy of processing and transmitting inputs
# serious deficiencies (audited)
% vendors paid correctly
# hours/days to respond to requests/inquiries
# days to process vouchers

G. CONSTRUCTION

% conformance to contract specifications (e.g. engineering services delivered on time and within estimated costs)
# days "slipped" between scheduled and actual contract award date
# claims per contract
# amendments required to be issued for a specification
# staff days required to correct and revise designs and specifications after field review

H. COMPLIANCE

% accurate documentation on activity inspected
# days to complete and submit report after final investigative pass
% final reports initially submitted that are clear and complete (as defined in program standards)

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