CHAPTER SIX

Measurement Program Implementation Approaches

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Introduction

Measurement processes have become a necessary and important part of today's software organization. To compete in an ever-changing, fast-moving, and competitive industry, one needs to work productively, efficiently, and with a high level of quality. The days of using "gut feel" to make decisions about development opportunities are over. Software organizations need a way to manage workload and decide what to do, how to do it, and when to do it. This is where measurement comes in. Having data and historical analyses about the organization aids in the decision-making process.

Most software professionals understand the need for measurement, but unfortunately, implementing a process that becomes repeatable and integrated into the software development and maintenance life cycle can still be a struggle. Often the struggle results from the culture change required in the organization. People think the process will be too difficult to manage, or they believe it is just a fad and will go away. These issues can be resolved by approaching the definition and implementation of the measurement process in a planned and organized method and by involving the development staff at appropriate times. A common mistake made by organizations is to decide they want a measurement process and then say "What data do we already have that can be analyzed?" This mistake can cause a measurement process to fail. Unless the

measures developed are meaningful and useful to all levels of the organization, the measurement process will not be successful.

The best approach to defining and implementing a measurement process is to first define what the organization needs or wants to know and then choose appropriate measures. Once the measures are defined, the next step is to focus on the specific data collection needed to support the measures. Specifically, the process involves the following steps, which will be discussed in detail in individual sections:

1. Define goals and initiatives
2. Define the measures to support the goals and initiatives
3. Define the data to support the measures
4. Define the reporting of the measures
5. Implement the process

Here are some benefits to be gained by following these steps:

- Goals and initiatives in organizations receive focus and attention. By defining measures associated with these goals and initiatives, the measures become part of something already in place, so they're meaningful to all employees. Integrating the measures is then easier. In addition, the measures help determine if the goals and initiatives are progressing as planned or if they need adjustments.
- To define goals and initiatives, employees at all levels of the organization must be interviewed. When employees are involved in defining the process, they take some ownership in what is eventually implemented, which again eases integration.
- Often organizations start off their measurement process with as many measures as they can think of. When the five steps are followed, the scope of measures can be managed so that data collection or analysis overwhelms no one.
- When collecting data, computing measures, and completing analyses, one may often hear the question "Why?" If the measures are tied to goals and initiatives, that question becomes easier to answer. A measurement specialist never wants to reply "Because it's required." When the steps are followed, the purpose of the measure is always documented and explained.

The five-step approach described in more detail in the following sections enables organizations to achieve the benefits and successfully implement a measurement program.

Step 1: Defining Goals and Initiatives

This is a key step in successfully implementing a measurement program. Without having an idea of what information the organization needs, a measurement group cannot provide it. This compares to a server in a restaurant bringing your dinner before you order. In the software industry, a comparison would be implementing a release before the requirements are defined. We all know that would never happen.

Goals and initiatives may vary from department to department or from level to level, so surveying a representative sample of the entire organization is imperative. This can be handled in department or team meetings throughout the organization or by selected individuals participating in separate goal-setting workshops. In either case, it is important to have a facilitated session that fosters openness and honesty. The session should involve brainstorming for goals or initiatives without limitation. Once all the goals and initiatives are defined, they can be prioritized.

During brainstorming of goals or initiatives, the facilitator should ask the following questions to trigger discussion:

- What does the organization want to know?
- What does the organization hope to accomplish this year? Next year? In five years?
- What decisions need to be made?
- What is the corporate vision?
- What initiatives are being implemented?
- What are customers continually mentioning?

To foster ideas from all levels of the organization, a good practice is to survey project team members separate from the management staff. In some organizations, individuals may be inhibited if their boss is in the room. After all sessions have been held, the facilitator can consolidate the information into one document that lists all the goals. Some examples of goals and initiatives are

- Improve project productivity (Goal)
- Improve project quality (Goal)
- Reduce project cost (Goal)
- Implement formal inspections (Initiative)

Often an organization is not aware of the current productivity or quality level, so the initial goals may need to be general. Once some measurement has been done

and the current level is known, more specific goals can be set (such as improve project productivity by 10 percent; improve project quality by 25 percent).

When the organization knows what goals are important, appropriate measures can be defined.

Step 2: Defining Measures

After defining the goals and initiatives, the next step is to define supporting measures. Each goal or initiative should be addressed individually to determine the measure or measures pertaining to that goal. One key question is, "What measure will show the status or progress of a particular goal or initiative?" It is appropriate to gain input from the groups that identified the goals, and the measurement definition is often completed in the initial workshop.

The facilitator might need to provide examples of common measures to aid the group. Lists of common measures are available in the International Function Point Users Group (IFPUG) manual, *Guidelines to Software Measurement*. In addition, various consulting companies provide training, onsite workshops, and resource material in this area.

Examples of measures for the previously defined goals are listed in Table 6-1.

After the goals and measures have been identified, it is a good time to prioritize the list. You want to provide enough information to the organization to be helpful, but avoid overwhelming people with too much information. One measure may support multiple goals, enabling more goals to be addressed. In selecting which goals and measures to initially implement, consider the following:

Table 6-1

Goal/Initiative	Measures
Improve project productivity (Goal)	Function points per hour
Improve project quality (Goal)	Delivered defects per function point
Reduce project cost (Goal)	Cost per function point
Implement formal inspections (Initiative)	Defect removal efficiency rate (defects found prior to implementation divided by total defects found)
	Delivered defects per function point

- **Measures for various groups:** Because multiple groups participated in the definition process, selecting at least one goal and measure from each group may be appropriate. This helps people see that their input has made a difference.
- **Top-priority measures:** Activities critical at the time of definition may dictate what measures to choose (for example, decisions being made about outsourcing, low customer satisfaction with quality).
- **Quick payback:** If an organization is concerned about acceptance of the measurement program, a helpful approach might be to select measures that can provide information and benefits quickly (for example, reduction of defects per function point due to formal inspections versus developing historical repository to improve estimating).

Step 3: Defining Data Collection

After choosing the initial set of measures, the data necessary to support the measures can be defined. During this step, the focus should be on the following:

- Data definitions
- Data collection points
- Data collection responsibilities
- Data collection vehicles

Each of these will be discussed in detail.

Data Definitions

Each piece of data necessary for a measure needs to be identified and defined in terms everyone can understand. For example, if the productivity measure of function points per hour is selected, function points and effort will be required. Effort needs to be defined based on what activities to include (requirement definition, design, coding, and so on). If an organization is planning to benchmark against industry data, identifying what activities are included in the industry numbers will ensure that accurate comparisons can be made. At a minimum, telling the benchmarker what data has been collected will be necessary so that the benchmark database can be filtered appropriately. The definitions may at first seem obvious, but it is amazing how different definitions can be. I have seen major discussions break out about defining a project completion date.

Data Collection Points

Data collection activities must be integrated with the development life cycle so the measurement becomes part of the process and is not perceived as something extra. Data should be collected only at the points necessary to support the selected measures. For example, if the goal is to improve project productivity, and the measure is function points per hour, you will need to count function points at implementation time. Effort, on the other hand, should be collected throughout the project life cycle. And if the goal is to manage change of scope in function points, the function point counting activity will be required multiple times during the project life cycle.

Data Collection Responsibilities

To ensure collection of the data, you need to define roles for collecting and reporting each piece of data. Various individuals may be responsible for recording, collecting, and reporting the data. Knowing the data definitions and collection points will aid in determining the most appropriate assignment of personnel for data collection and reporting responsibilities. The approach chosen for establishing measurement of staff resources may also have an effect. These approaches are discussed later in the chapter.

Data Collection Vehicles

Wherever possible, utilize existing data collection forms or systems. Avoid reinventing the wheel; this just adds additional overhead and confusion to the process. There are automated tools that can help with some of the data collection. However, knowing the data collection requirements is important prior to selecting a tool. While defining the forms or methods of data collection, you also need to define the process of providing the data to the measurement personnel.

Examples of data definition, data collection points, data collection responsibilities, and data collection vehicles are documented in Table 6-2 in the Data Definition and Responsibility columns.

Now that the initial measures and required data have been defined, the means of reporting the data can be developed.

Table 6-2

Goal/Initiative	Measures	Data Definition	Responsibility
Improve project productivity (Goal)	Function points per hour	Function points counted at project implementation Effort captured throughout project life cycle	Function point specialists along with subject matter experts (record data in a spreadsheet) Developer (records data in time entry system)
Improve project quality (Goal)	Delivered defects per function point	Function points counted at project implementation Delivered defects after implementation for three months	Function point specialists along with subject matter experts (record data in a spreadsheet) Help desk (records data in defect tracking system when reported by users)
Reduce project cost (Goal)	Cost per function point	Function points counted at project implementation Labor cost calculated based on effort Non-labor cost captured throughout the project	Function point specialists along with subject matter experts (record data in a spreadsheet) Project manager (calculates and records data on project completion form)

(*continued*)

Table 6-2 (***continued***)

Goal/Initiative	Measures	Data Definition	Responsibility
Implement formal inspections (Initiative)	Defect removal efficiency rate (defects found prior to implementation divided by total defects found) Delivered defects per function point	Function points counted at project implementation Defects found prior to implementation Delivered defects after implementation for three months	Function point specialists along with subject matter experts (record data in a spreadsheet) Inspectors and measurement analysts (record data on defect form and in a spreadsheet) Help desk (records data in defect tracking system when reported by users)

Step 4: Defining Reports

The next step in defining the measurement process is to define, develop, and document the reporting of the selected measures. Specifically, you need to determine the reporting audience, the reporting frequency, and the reporting format.

The various audiences identified may have different needs or focuses, requiring unique reporting. The targeted audiences should be involved in reviewing the proposed reporting to ensure their needs are met. People involved in the data collection should also be considered as an audience. The individuals providing the information need to receive some benefit from the process for it to continue effectively. Specifically, the project team should receive analysis and reporting on their projects. The project team typically provides most of the data, so they should receive the benefits of their activities. Also, the project team can use the data to identify improvements for their next project. If the project team receives

the information, it will be involved in any necessary process changes and be more committed to implementing the changes.

Although the format and layout of the reports can be initially defined during the development of the process, it may be appropriate to wait until actual data is available to determine the scales that best show what the data represents.

A key aspect of the reporting is to leave physical space on the page for observations. Data should not be reported without any context or explanation. Analysis of the data is necessary to make sure the information is interpreted and used appropriately by the audiences. Specifically, the reports should discuss the following:

- **Findings:** What was seen. "Delivered defects per function point have decreased in the last reporting period for certain areas."
- **Conclusions:** What the analysis is saying. "The decrease in delivered defects in these areas can be attributed to the implementation of formal inspections throughout the life cycle."
- **Recommendations:** How to proceed. "Formal inspections should be considered for roll-out to the entire organization."

Step 5: Implementing the Measurement Process

This section describes implementation approaches in the areas of roll-out, staffing needs, process and methods development, and education.

The implementation of the measurement process requires planning and development, as well as decision-making in the areas of roll-out and staffing. The approaches taken will depend on the staffing levels and structure of the organization. Alternatives are presented for the implementation of roll-out and staffing.

Roll-out

The defined measurement process can be rolled out to the organization in various ways:

- Across the entire organization at once
- On selected projects or applications across several areas or departments
- In selected areas or departments in phases until the process is incorporated throughout the organization

Tables 6-3 through 6-5 show pros and cons to each approach.

Table 6-3: Across Entire Organization

PROS	CONS
Everyone is involved right away.	Consistency is difficult to control.
All the training is completed at once.	Any necessary adjustments involve everyone.
Data is obtained on the entire organization's portfolio.	Benefits may not be quickly visible with high volumes of data collection slowing analysis, management, and reporting.
Positive outcomes are seen throughout the organization.	Any negative impacts are seen throughout the organization.

Table 6-4: Selected Projects or Applications Across Several Areas

PROS	CONS
Amount of data is initially manageable.	Implementation is difficult as a repeatable process because it is seen as a one-time initiative.
Initial impact on staff is minimal.	Limited data across several areas makes trends difficult to see.
Small focus allows for dedicated attention.	Staff is trained on processes they may not use day-to-day.

The decision on how to staff the measurement program may impact the roll-out approach and visa versa, so roll-out and staffing decisions should be considered concurrently.

Staffing Needs

The developers need to be responsible for some of the data being collected (for example, effort, cost, and defects). Developers will also need to have methods for recording project data accurately and consistently. However, the overall measurement activities, such as function point counting and data analysis, might require more time than the developers have.

Table 6-5: Phased Implementation by Selected Areas or Departments

PROS	CONS
Can train staff that will be utilizing the skills on a regular basis.	Not all areas are initially involved.
Can collect enough data points to see trends to provide opportunities for process improvement.	Highlighting chosen departments may cause concern for some staff.
Small focus allows process to be adjusted as necessary with small impact on staff.	Time is longer before data becomes available on entire organization.
Staff can see the entire measurement process from impacts to benefits.	
Consistency of data collection is greater.	

The following staffing alternatives can be used for counting function points, maintaining the data repository, and completing the analyses and reporting activities.

1. Assign a resource within each department.
2. Utilize external resources.
3. Establish a central metrics group.

Tables 6-6 through 6-8 show the pros and cons for each approach. Depending on the resources within the organization, different companies select different options. Combinations of these options may also be necessary. For example, it is imperative that measurement knowledge and expertise be a part of the initial setup and implementation of the measurement program. This may require external resources up front to educate staff, but after the knowledge has been transferred, an internal metrics group can be established.

After the staffing decisions have been made, the detail process and methods and educational materials can be developed and presented.

Process and Methods Development

Establishing the measurement process and methods is a required activity regardless of the roll-out and staffing decisions.

Table 6-6: Resource Within Each Department

PROS	CONS
System expert and function point expert may be the same person.	Reviewing processes to ensure consistency is more involved.
Ownership of the data is stronger.	The selected individual may become overwhelmed with FP counts, data analysis, and reporting.
Scheduling function point counting sessions may be more timely.	Having resources focused on their individual areas may make data analysis regarding organizational trends more difficult.
	Staff turnover would require identification of replacements.

Table 6-7: External Resources

PROS	CONS
No learning curve for expert data analysis and function point counting.	Additional resource costs are required
Staff turnover would not be an issue.	Scheduling of function point counts may not be timely.
Accuracy and consistency are strong from the start.	Knowledge transfer to the organization has to be defined as part of the measurement program.

Prior to implementing the measurement program, the process and methods for data collection and reporting must be defined and documented. This involves integrating into the development life cycle the specific measurement activities that must occur, when they should occur, and how they should occur. All forms, tools, and report formats should be defined to ensure the process is implemented consistently, accurately, and effectively for all those involved. This can be a time-consuming and not always exciting activity for the planners, but a necessary one for implementing a standard, integrated, and repeatable process.

Table 6-8: Central Metrics Group

PROS	CONS
Consistency and accuracy is developed more quickly with a focused metrics team.	Measurement and function point knowledge is centralized and ownership of the process is limited unless appropriate education is undertaken.
Analysis and reporting throughout entire organization is more easily completed with a central data collection point.	Scheduling of function point counts in a timely manner requires good communication.
Development staff is impacted for system or project expertise only during the counts and not in reviews and documentation.	Without appropriate education, the data analysis and reporting process may not appear owned by the development staff.

Education

Appropriate education is necessary for all those involved in the process, based on their assigned activities or use of the measurement information. Table 6-9 shows examples of the types of education and training necessary for various audiences.

Table 6-9: Education and Training

Audience	Sample Training
Metrics Group	Function Point Training
	Analysis and Reporting Education
	Software Project Estimating
	Measurement Methods
	Function Point Repository and Data Analysis Tools
Developers	Education on the processes and developer involvement
	Function Point Training
Managers	Education on the analysis and use of the data

Summary

For organizations to successfully implement a measurement program, they must provide meaningful and useful data to all levels of the organization. To ensure that appropriate information is reported, the following is the best approach:

1. Define the organization's goals and initiatives.
2. Define the measures to support the goals.
3. Define the data necessary to calculate the measures.

If organizations do not plan ahead for what they want to know, the data collected is not likely to meet their needs.

After the first sets of measures are successfully implemented, the goals can be reviewed to determine the next set of measures to define and roll out. Based on the success in reaching the defined goals or implementing the defined initiatives, additional goals/initiatives and measures may need to be defined. The measurement process should be a continual cycle of measuring, reviewing, establishing goals, and refining and defining measures.

Biography

Lori Holmes is a managing consultant with Q/P Management Group, specializing in Total Quality Management (TQM), software measurement, and process improvement. Her areas of expertise include function point analysis, software quality assurance, and managing customer satisfaction. Lori is recognized as an international consultant, speaker, and instructor. She focuses on helping organizations implement quality and productivity improvement programs by utilizing measurement techniques. She is an experienced instructor in TQM, quality inspections, problem-solving techniques, and function point analysis.

Previously Lori was a quality associate for First Data Corporation, an organization providing support for bankcard processing, cable television processing, and WATS marketing. Prior to this she was the quality assurance manager within a systems and programming organization. She was responsible for developing and monitoring processes and procedures to assure quality in all application development efforts. Lori was also an applications programming manager, leading four technical teams. She was responsible for applications development and day-to-day production issues.

Ms. Holmes received her bachelor of science in Business Administration with a Business Information Systems focus from Illinois State University in 1984. She became a Certified Quality Analyst through the Quality Assurance Institute in Orlando, Florida, in 1990. She is also certified to facilitate workshops in the areas of software metrics, benchmarking, customer service, teamwork, empowerment, and organizational change. Lori has been certified by the International Function Point User Group as a Certified Function Point Specialist.

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