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People Capability Maturity Model[®] (P-CMM[®])

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Quantitative Performance Management

A process area at Maturity Level 4: Predictable

Purpose **The purpose of Quantitative Performance Management is to predict and manage the capability of competency-based processes for achieving measurable performance objectives.**

Description At the Predictable Level, the organization strengthens its management of performance, by beginning to manage its most important competency-based processes from analysis of performance data. Quantitative Performance Management practices are consistent with programs such as Six Sigma [Harry 00, Pande 00] that seek to install a discipline of quantitative process analysis into the management of an organization's business activities. Not all business activities need to be managed quantitatively, but those with the strongest influence or control over important business outcomes should be candidates for the practices of this process area.

Measurable performance objectives are established for units and are then allocated to individuals and workgroups. Workgroups establish their measurable performance objectives. Individuals and workgroups determine which competency-based processes contribute most to achieving unit objectives and set measurable objectives for the performance of these processes. Committed work is estimated and planned using process performance baselines developed from past performance of the relevant competency-based processes.

A quantitative performance management strategy is developed for identifying, measuring, and analyzing the performance of the competency-based processes that most contribute to achieving unit objectives. Performance data are collected and analyzed according to this strategy. The performance of these competency-based processes is managed quantitatively and these processes are brought under quantitative control.

Corrective actions are taken when the performance of competency-based processes deviates significantly from performance objectives. Performance data are captured for future use and are used in performing selected workforce practices and activities.

Goals

- Goal 1** **Measurable performance objectives are established for competency-based processes that most contribute to achieving performance objectives.**
- Goal 2** **The performance of competency-based processes is managed quantitatively.**
- Goal 3** **Quantitative Performance Management practices are institutionalized to ensure they are performed as defined organizational processes.**

Commitment to Perform

- Commitment 1** **The organization establishes and maintains a documented policy for conducting Quantitative Performance Management activities.**

Issues typically addressed in the policy include:

1. The organization is committed to continuous improvement by measuring and managing performance results at the individual, workgroup, and unit levels.
2. The organization's Quantitative Performance Management activities serve the business objectives and stated values of the organization.

3. Measurable goals are established for those aspects of performance at the individual, workgroup, and unit levels that are most closely related to the organization's business objectives.
4. Performance against measurable objectives is analyzed and reported.
5. Responsibilities for Quantitative Performance Management activities are defined and assigned to appropriate roles.
6. Results of Quantitative Performance Management analyses are used in managing performance and adjusting workforce activities.
7. Quantitative Performance Management practices and activities comply with relevant laws, regulations, and organizational policies.

Human resources or other appropriate professionals are consulted to ensure that collection, use, and access to performance data complies with relevant laws, regulations, and organizational policies.

Commitment 2 **An organizational role(s) is assigned responsibility for coordinating Quantitative Performance Management activities across the organization.**

Ability to Perform

Ability 1 **Within each unit, an individual(s) is assigned responsibility and authority for ensuring that Quantitative Performance Management activities are performed.**

Ability 2**Adequate resources are provided for performing Quantitative Performance Management activities.**

1. The organization makes available business objectives that can be decomposed to establish measurable performance objectives at the unit level.

Examples of the business objectives that might be a source for Quantitative Performance Management activities include the following:

- Improving quality as measured or perceived by the customer
- Reducing maintenance or service costs
- Shortening delivery schedules or response times
- Improving productivity, yield, or profits
- Accelerating innovation
- Improving coordination or efficiency among organizational units

2. Measurements of performance are collected and made available for analysis.

The initial measurements required to support this practice were defined in the Performance Management, Workgroup Development, Competency Integration, and Empowered Workgroups process areas. As Quantitative Performance Management activities mature, additional or refined measures may be defined.

3. Process performance baselines for competency-based processes are made available for use in performing quantitative management activities.

Refer to Practice 7 of the Organizational Capability Management process area for information regarding developing process performance baselines for competency-based practices.

4. Experienced individuals with appropriate expertise are available to help individuals, workgroups, and those responsible for unit performance analyze and use quantitative performance results to:
 - understand and predict performance,
 - improve performance, and
 - adjust performance-based practices and activities.

5. Resources for supporting Quantitative Performance Management activities are made available.

Examples of resources to support Quantitative Performance Management activities include the following:

- Plotting and graphing tools
- Statistical analysis packages
- Spreadsheets
- Performance assessment instruments
- Databases and other repositories
- Textual and graphical reporting tools

6. Funding to accomplish Quantitative Performance Management activities is made available.
7. Adequate time is made available for performing Quantitative Performance Management activities.

Ability 3

Individuals who participate in Quantitative Performance Management activities develop the knowledge, skills, and process abilities needed to perform their responsibilities.

1. Those who provide performance data receive orientation on the definitions of performance data and the use of these performance data in analyses.
2. Those who receive quantitative performance management analyses receive orientation in how the results were generated and how to interpret them.
3. All individuals who are responsible for adjusting performance-related workforce practices receive preparation in how to make such adjustments.
4. All individuals or workgroups who use performance data to understand or improve their performance receive orientation in the proper interpretation and use of these data.

Ability 4**The practices and procedures for performing Quantitative Performance Management are defined and documented.**

1. Practices and procedures are defined and documented at the organizational or unit levels, as appropriate.
2. Guidelines for tailoring the practices and procedures for use in different circumstances are documented and made available, as necessary.
3. The individual(s) assigned responsibility for coordinating Quantitative Performance Management activities across the organization ensures that defined practices and procedures are:
 - maintained under version control,
 - disseminated through appropriate media,
 - interpreted appropriately for different situations, and
 - updated through orderly methods.
4. Experiences, lessons learned, measurement results, and improvement information derived from planning and performing Quantitative Performance Management practices are captured to support the future use and improvement of the organization's practices.

Practices Performed

Practice 1**The quantitative performance objectives required to achieve organizational business objectives are defined.**

1. The organization's business objectives are analyzed to identify the quantitative performance objectives required to achieve them.
2. The organization's quantitative performance objectives are:
 - decomposed when it is necessary to allocate them to units, workgroups, workforce competencies, or other organizational entities;
 - revised, when necessitated by business strategy or conditions; and
 - communicated to units.

3. Feedback is obtained from units on their ability to translate organizational performance objectives into measurable unit performance objectives.
4. Methods for establishing more effective quantitative performance objectives are improved using feedback from units.

Practice 2

Each unit establishes measurable performance objectives whose achievement most contributes to organizational business objectives.

Refer to Practices 1 and 2 of the Performance Management process area for information regarding how units establish, update, and allocate performance objectives. Refer to Ability 2 of this process area for information regarding making business objectives available to units and the workforce to support establishing measurable performance objectives. To support practices and activities in this process area, these measurable performance objectives must be defined at a level of specificity that they can be decomposed into quantifiable results for each unit. At lower levels of maturity, the requirement was only for objectives whose performance could be evaluated objectively.

1. Units define their measurable performance objectives based on business objectives established by the organization.
2. Units identify the business activities most critical to the achievement of their measurable performance objectives and establish methods for measuring the performance and effectiveness of these activities.
3. The unit reaches consensus with individuals and workgroups about methods for measuring the performance and effectiveness of critical business activities allocated to them.

Practice 3**Individuals and workgroups establish measurable performance objectives for competency-based processes that most contribute to their achieving unit performance objectives.**

Measurable performance objectives for units were established in the Performance Management process area. Refer to Practices 1 and 2 of the Performance Management process area for information regarding how units establish, update, and allocate performance objectives.

It may not always be possible for a unit to establish measurable performance objectives for its processes, as all individuals or workgroups within the unit may not use common processes. Several competencies, each having their own defined processes, may exist within a single unit. For example, a software development unit may be comprised of software architects, designers, programmers, and testers who work in independent workgroups to perform their own competency-based processes.

This practice focuses on establishing measurable performance objectives for those competency-based processes that contribute most to achieving desired performance. The kinds of processes that measurable objectives may be established for include the following:

- Defined processes, which are those competency-based processes defined in each workforce competency. Refer to Practices 2 and 5 of the Competency Analysis process area for information regarding the identification and definition of defined, competency-based processes.
- The workgroup's operating processes, which include both methods and procedures for performing common workgroup functions and competency-based processes tailored for use by workgroups. Refer to Practices 4 and 7 of the Workgroup Development process area and to Practices 4 and 5 of the Empowered Workgroups process area for information regarding the definition and tailoring of the workgroup's operating processes.
- Integrated competency-based processes, which are those processes that have been integrated from the separate defined processes used by different workforce competencies. Refer to Practice 3 of the Competency Integration process area for information regarding the definition of integrated competency-based processes.

Individuals and workgroups:

1. Determine the business activities that must be completed to achieve the unit's measurable performance objectives.
2. Identify the competency-based processes required to accomplish these business activities.
3. Select from the identified processes those competency-based processes that most contribute to the achievement of the unit's measurable performance objectives.
4. Establish measurable objectives for the performance of these selected competency-based processes to ensure that the unit's measurable objectives are achieved.
5. Evaluate measurable performance objectives against work estimates and plans based on analyses, using the relevant process performance baselines, to determine whether they can be achieved.
6. Take action when competency-based processes are determined not to be capable of achieving their measurable performance objectives by:
 - adjusting the performance objectives to reflect the current capability of the processes involved,
 - identifying improvements in the capability of relevant competency-based processes required to achieve measurable performance objectives, and
 - communicating the capability improvements needed to those responsible for improving the capability of competency-based processes.

Refer to Practice 12 of the Continuous Capability Improvement process area for information regarding identifying opportunities for improving the capability and performance of competency-based processes.

7. Incorporate measurable performance objectives for competency-based processes into individual and workgroup performance objectives, as appropriate.
8. Re-evaluate measurable performance objectives when necessitated by changes in business conditions or process capability results, and revise individual or workgroup performance objectives, as appropriate.

Practice 4**Individuals and workgroups plan their committed work using process performance baselines for competency-based processes.**

A *process performance baseline* is a documented characterization of the actual results achieved by following a process, which is used as a benchmark for comparing actual process performance against expected process performance. The organization's process performance baselines measure performance for selected competency-based processes within the organization's set of standard processes at various levels of detail, as appropriate. Process performance baselines may be established at various levels of process detail, including the following:

- Individual process elements (e.g., specific process elements within a competency-based process)
- Sequences of connected processes
- Processes for developing individual work products

There may be several process performance baselines to characterize performance for individuals and workgroups within the organization, stratified by conditions under which performance might be expected to differ.

Individuals and workgroups:

1. Identify the competency-based processes required to accomplish their business activities.
2. Identify relevant process performance baselines established for the competency-based processes to be performed in accomplishing their business activities.

Refer to Practice 7 of the Organizational Capability Management process area for information regarding developing process performance baselines for competency-based processes. Individuals or workgroups may have established process performance baselines from their own previous performance that are more accurate or relevant than organizational baselines.

Different baselines may be established for different conditions under which competency-based processes are performed. Examples of conditions that may affect the performance of competency-based processes and justify the creation of alternate baselines include the following:

- The level experience or proficiency of the individuals performing the processes
- Organizational or business conditions
- Specific method(s) used in performing the processes
- The nature of the product or service for which the processes are performed

3. Develop work estimates and plans based on analyses using the relevant process performance baselines.

When individuals perform their business activities as members of a workgroup, capability-based estimating may be performed in two stages. In the first stage, individuals estimate and plan their own work based on personal process performance baselines. In the second stage, these personal estimates and plans are integrated at the workgroup level in estimating and planning workgroup performance.

4. Evaluate the planned performance of competency-based processes to determine if they are capable of achieving measurable individual and workgroup performance objectives.
5. Make recommendations for adjustments in measurable performance objectives when competency-based processes are not capable of achieving them.
6. Establish and negotiate work commitments based on capability-based estimates and plans.

Practice 5**Individuals and workgroups define quantitative methods for managing the competency-based processes that most contribute to achieving their performance objectives.**

Competency-based processes are quantitatively managed to ensure they are capable of achieving measurable performance objectives and that their performance makes predicted progress toward planned outcomes. Not all processes need to be quantitatively managed. Primarily those competency-based processes believed to most contribute to or control achieving measurable performance objectives are subjected to quantitative management. The outcomes of quantitative management are predictable results obtained through predictable performance.

1. A quantitative performance management strategy is developed for each competency-based process selected for quantitative management.

Competency-based processes can be quantitatively managed at the individual level, at multiple points of performance within the workgroup, or at the workgroup level. The level at which competency-based processes are quantitatively managed may differ across processes. Individuals or workgroups may have different quantitative performance management strategies, based on having different measurable performance objectives or different contexts for the performance of their competency-based processes. In some cases, processes that are performed across workgroups may be quantitatively managed. Some processes may be managed through performance measures such as effort, duration, or cost; while others may be managed from measured attributes of their products or services such as amount, user satisfaction, defects, or other quality measures. Generally, a specific quantitative performance management strategy is defined for each competency-based process selected for quantitative management.

Examples of issues to be covered in the quantitative performance management strategy include the following:

- Measurable performance objectives that establish the context for quantitative management
- Identification of the competency-based processes to be quantitatively managed
- Measures to be used in the analyses
- Appropriate level of data aggregation (individual, workgroup, etc.) for the measures and analyses defined
- Methods and frequency of data collection
- Methods for data validation, storage, and retrieval
- Data analyses to be performed
- Guidance and limitations for evaluating results
- Reports to be distributed
- Methods and tools to support using results
- Safeguards to ensure the privacy and security of data and results

2. Measures of competency-based processes are defined and agreed to.

Examples of sources for defined measures of competency-based processes include the following:

- Definitions of competency-based processes
- Existing process performance baselines for relevant processes
- Standard business, product, or service measures

3. Procedures for analyzing data on competency-based processes are defined.

Examples of analyses that might be performed include the following:

- Curve-fitting or trend analyses
- Statistical process control
- Regression or multivariate predictive techniques
- Stochastic or time-series techniques
- Classification analyses (e.g. defect or problem types)
- Analyses of leading indicators

4. The quantitative performance management strategy is:
 - reviewed and agreed to by all individuals or groups affected by it,
 - reviewed and approved by unit management, and
 - periodically reviewed to ensure its consistency with performance objectives and revised, as necessary, to improve the value of the analyses performed.

Practice 6**Individuals and workgroups quantitatively manage the performance of the competency-based processes that most contribute to achieving their performance objectives.**

1. Quantitative performance management activities are conducted according to the quantitative performance management strategies.
2. The performance of competency-based processes by individuals or workgroups is measured and analyzed for use in such activities as:
 - tracking progress,
 - predicting outcomes,
 - assessing risks,
 - making decisions, or
 - identifying needed actions.

Examples of how quantitative analyses might be used include the following:

- Establishing process performance baselines from the performance of individuals and workgroups to determine if they are capable of achieving the measurable performance objectives set for them, and whether they differ from organizational baselines established within the competency
- Using interim performance results to predict future outcomes and determine the likelihood that measurable performance objectives will be achieved
- Analyzing variations in process results to understand and control process performance, and to identify needs for corrective action
- Evaluating trends or comparing predicted to actual results to determine whether current progress or results deviate from those planned or expected
- Analyzing factors that affect performance to improve the validity of process performance baselines, and to establish appropriate baselines for different situations

3. The capabilities of competency-based processes that most contribute to achieving performance objectives are:
- computed using parameters from organizational process performance baselines, where appropriate,
 - compared to organizational process performance baselines, and
 - recomputed for use by individuals and workgroups when their capability levels differ significantly from organizational baselines.

4. The capabilities of competency-based processes that most contribute to achieving performance objectives are brought under quantitative control.

Quantitative control may be established at the individual or workgroup level. Thus, bringing the capability of a competency-based process under control may imply actions to be taken by individuals, by workgroups, by managers, or by some combination of these. Examples of attributes of processes under quantitative control include the following:

- Process performance and variation are under statistical control
- Process performance and results are predictable
- Variations in process performance and results can be predicted when the effects of controlling factors and assignable causes are considered
- Process performance or results can be intentionally altered by making known changes to processes or factors that control them
- Process performance or results fit known patterns in quantitative models

5. Individuals, workgroups, and management base decisions on performance data.
6. Results of data collection and analyses are reviewed to determine if corrective actions need to be taken in the quantitative performance management strategy.

Practice 7

Individuals or workgroups take corrective actions when the performance of their competency-based processes differs from the quantitative results required to achieve their performance objectives.

1. The results of quantitative management activities are evaluated for their implications regarding achievement of measurable individual and workgroup performance objectives.

Examples of conditions under which corrective actions may be indicated include the following:

- Performance trends that differ significantly from performance objectives
- Predictions of outcomes that differ significantly from expectations or objectives
- Large variations in process performance that introduce risk in achieving objectives
- Deviations from acceptable capability levels

2. The performance of competency-based processes is analyzed to identify factors that cause their results to deviate from measurable performance objectives.
3. Individuals or workgroups take corrective actions to align the performance of competency-based processes with measurable performance objectives.

Examples of corrective actions may include the following:

- Removing or adjusting factors that inhibit competency-based processes from performing at their established level of capability
- Eliminating or controlling factors that affect process performance (i.e., controlling assignable causes of process variation)
- Adjusting measurable performance objectives to reflect the capability results observed in performing competency-based processes
- Informing management of the risk incurred by the capability results observed in performing competency-based processes
- Receiving management approval for performance below expected capability levels

4. When the performance of competency-based processes has been aligned with measurable performance objectives, individuals and workgroups:
 - continue to monitor performance results according to the quantitative performance management strategy,
 - manage the performance of competency-based processes to ensure they exhibit stable or predictable performance,
 - manage the effects of assignable causes or other factors that inhibit competency-based processes from maintaining the level of capability they have established in their current use, and
 - take additional corrective actions, as needed, to maintain the alignment of process performance results with measurable performance objectives.

Practice 8**Quantitative records of individual and workgroup performance are retained.**

1. Individuals and workgroups retain data on their performance of competency-based processes for their future use in estimating, planning, and managing their performance.
2. Performance data that are appropriate for characterizing the capability of competency-based processes are submitted for use in organizational capability analyses.

Refer to the Organizational Capability Management process area for information regarding organizational capability analyses.

3. Information regarding needed improvements in the capability of competency-based processes is communicated to those responsible for continuous improvement activities in each competency community.

Refer to the Continuous Capability Improvement process area for information regarding continuous improvement activities for competency-based processes.

4. Privacy and security are established for quantitative performance management data and information at the individual, workgroup, and organizational levels.

Practice 9

Where appropriate, quantitative performance results are used in performing workforce practices and activities.

The use of quantitative performance management data in performing workforce activities must be governed by policies regarding appropriate uses and levels of confidentiality for performance data at the individual and workgroup levels.

Examples of ways in which quantitative performance management data might be used in performing workforce activities include the following:

- Identifying learning and development needs
- Aiding mentors in providing improvement advice and guidance
- Guiding career development discussions and decisions
- Aiding selection and other staffing decisions
- Supporting ongoing communication about performance of committed work
- Documenting accomplishments against performance objectives
- Guiding performance improvement plans and actions
- Providing a basis for recognition and rewards
- Supporting adjustments and other compensation decisions
- Improving competency development activities
- Improving competency integration activities
- Improving competency-based processes and/or competency-based assets
- Improving the development or empowerment of workgroups
- Incorporating capability levels into workforce planning

Measurement and Analysis

Measurement 1 **Measurements are made and used to determine the status and performance of the organization's Quantitative Performance Management activities.**

Examples of measurements include the following:

- The completeness and timeliness of the data collected
- The accuracy of the data collected
- Frequency with which individuals and workgroups collect and analyze performance data
- Number or extent of changes made in competency-based and integrated competency-based processes, based on performance results
- Number of process performance baselines produced by individuals and workgroups
- Number of process performance baselines submitted for use in organizational capability analyses.

Measurement 2 **Measurements are made and used to determine the effectiveness of Quantitative Performance Management activities.**

Examples of measures to determine the value and effectiveness of Quantitative Performance Management activities at the individual, workgroup, or unit levels include the following:

- Improvements in capability and performance
- Extent to which measurable performance objectives are achieved
- Improved ability to identify and manage factors that affect performance
- Improved accuracy of predicting performance results

Verifying Implementation

Verification 1 **A responsible individual(s) verifies that Quantitative Performance Management activities are conducted according to the organization’s documented policies, practices, procedures, and, where appropriate, plans; and addresses noncompliance.**

These reviews verify that:

1. Quantitative Performance Management activities comply with the organization’s policies and stated values.
2. Quantitative Performance Management activities comply with relevant laws and regulations.
3. Quantitative Performance Management activities are performed according to the organization’s documented practices and procedures.
4. Noncompliance issues are handled appropriately.

Verification 2 **Executive management periodically reviews the Quantitative Performance Management activities, status, and results; and resolves issues.**

These reviews verify:

1. The appropriateness of Quantitative Performance Management activities at the individual, within the workgroup, at the workgroup, and at the unit levels.
2. Progress in performing Quantitative Performance Management activities.
3. Results from reviews of Quantitative Performance Management practices and activities.

Refer to Verification 1 for information regarding reviews of Quantitative Performance Management activities to ensure adherence to the following:

- Relevant laws and regulations
- Organizational policies, practices, and procedures

4. Status of resolution of noncompliance issues.
5. Trends related to Quantitative Performance Management.
6. The organization's effectiveness of Quantitative Performance Management activities in achieving quantitative performance objectives.

Verification 3

The definition and use of performance measures at the individual, workgroup, and unit levels are periodically audited for compliance with the organization's policies.