MePPLa: Measurement Planning Pattern Language

Specification

Version 1.1

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Summary

MePPLa: Measurement Planning Pattern Language

This document presents MePPLa's specification.

1. Introduction

Patterns are vehicles for encapsulating knowledge. They make it possible to capture what must be done in order to solve a given problem (DEUTSCH, 2004). In Software Engineering, a pattern language (PL) is a network of interrelated patterns that defines a process for a systematic solution of software development related problems (DEUTSCH, 2004). Therefore, MePPLa *(Measurement Planning Pattern Language)* is a pattern language composed of a set of inter-related patterns that when used together assist the elaboration of measurement plans suitable for statistical process control (SPC).

In MePPLa, each pattern is related to processes and follows the GQM – *Goal-Question-Metric* – format (BASILI *et al.*, 1994). Accordingly, a pattern of measurement planning includes a measurement goal, questions which indicate information needs that must be answered so it is possible to monitor the measurement goal, and measures (plus their operational definitions) that address the information needs.

MePPLa is represented through two types of model, namely: the structural model and the behavioral (or process) model. The structural model presents the patterns which compose the language and the structural relationships (dependency, correlation and composition) between them. The behavioral model, in turn, defines the flow which guides in the patterns application.

MePPLa was developed to support organizations which desire submiting some process to SPC or implementing SPC practices aiming at the high maturity (e.g., CMMI (CMMI Institute, 2010) levels 4 and 5 or MR-MPS-SW (Montoni et al., 2009) levels B and A). MePPLa includes patterns related to Project Management, Coding, and Testing processes.

MePPLa should be used to assist in the creation of measurement plans suitable for SPC. To use MePPLa, the user should start by using the general behavioral model, from which s/he should select, one at a time, the processes to be submitted to SPC. Selecting a process, the user should now use the behavioral model related to this process and navigate the model following the flow and selecting the patterns to be applied. Selecting a pattern means it will be inserted in the Measurement Plan to be created. Each process has, besides the behavioral model, a structural model, which can be used by the user to help pattern selection. For instance, in the structural model it is possible to identify correlated patterns,

i.e., those which have measures or goals which impact each other. Selecting correlated patterns can help measurement analysis.

MePPLa has 28 patterns: 12 related to the Project Management process, 6 to the Coding process, and 10 to the Testing process. Table B.1 shows the patterns related to each process and the measurement goal which leads to use each pattern.

Table 1 – MePPLa patterns.

Process: **Project Management**	
Measurement Goal	**Pattern**
Improve size estimation	Size Estimate Accuracy
Improve activity effort estimation	Activity Effort Estimate Accuracy
Improve phase effort estimation	Phase Effort Estimate Accuracy
Improve processes effort estimation	Process Effort Estimate Accuracy
Improve activity duration estimation	Activity Duration Estimate Accuracy
Improve phase duration estimation	Phase Duration Estimate Accuracy
Improve process duration estimation	Process Duration Estimate Accuracy
Improve activity cost estimation	Activity Cost Estimate Accuracy
Improve phase cost estimation	Phase Cost Estimate Accuracy
Improve process cost estimation	Process Cost Estimate Accuracy
Monitor schedule performance	Schedule Performance
Monitor cost performance	Cost Performance
Process: **Coding**	
Measurement Goals	**Pattern**
Improve coding productivity	Coding Productivity
Improve coding quality	Coding Quality
Improve product quality	Product Quality
Improve product reliability	Product Reliability
Improve defects fixing effectiveness	Defect Fixing Effectiveness
Reduce injected defects	Defect Injection
Process: **Testing**	
Measurement Goals	**Pattern**
Improve test effectiveness	Test Effectiveness
Improve unit test effectiveness	Unit Test Effectiveness
Improve system test effectiveness	System Test Effectiveness
Improve integration test effectiveness	Integration Test Effectiveness
Improve test efficiency	Test Efficiency
Improve unit test efficiency	Unit Test Efficiency
Improve system test efficiency	System Test Efficiency
Improve integration test efficiency	Integration Test Efficiency

Table 1 – MePPLa patterns (cont.).

Process: **Testing**	
Measurement Goals	**Pattern**
Improve productivity in test preparation	Test Preparation Productivity
Improve efficiency in test preparation	Test Preparation Efficiency

Being a pattern language, MePPLa can be constantly evolved. Thus, new patterns can be added, new relations can be identified, and new processes can be addressed in the future.

Next, in Section 2, MePPLa's structural models will be shown. In Section 3, the behavioral models will be presented, and in Section 4 the detailed description of each pattern will be provided.

2. MePPLa Structural Model

The structural model shows the patterns which compose the language and their structural relations. The visual notation OPL-ML, proposed by Quirino (2016), was utilized to represent the models, in which the patterns are represented by rectangles with underlined labels and the pattern groups are represented by straight lines with blue thick borders.

The patterns are grouped according to the processes and sub-processes which relate to each other. Internal to the groups, the patterns and relationships between them are represented. Dependency relationships are represented by directed arrows where the arrow's origin pattern requires that the target pattern be applied. Relationships represented by dashed arrows with double points indicate that the patterns are correlated, that is, there is a relationship between the patterns, but does not imply the need to apply the pattern to the other be applied.

Information about structural relations are especially useful during the analysis of data collected for the measures, because they reveal correlated measures and goals that impact each other. The structural model is particularly useful to elaborate the behavioral model (presented in the next section), since it indicates the dependencies that should be considered in the flow that guides the selection of the patterns to be applied.

Figure 1 presents the structural model containing patterns related to the Project Management process.

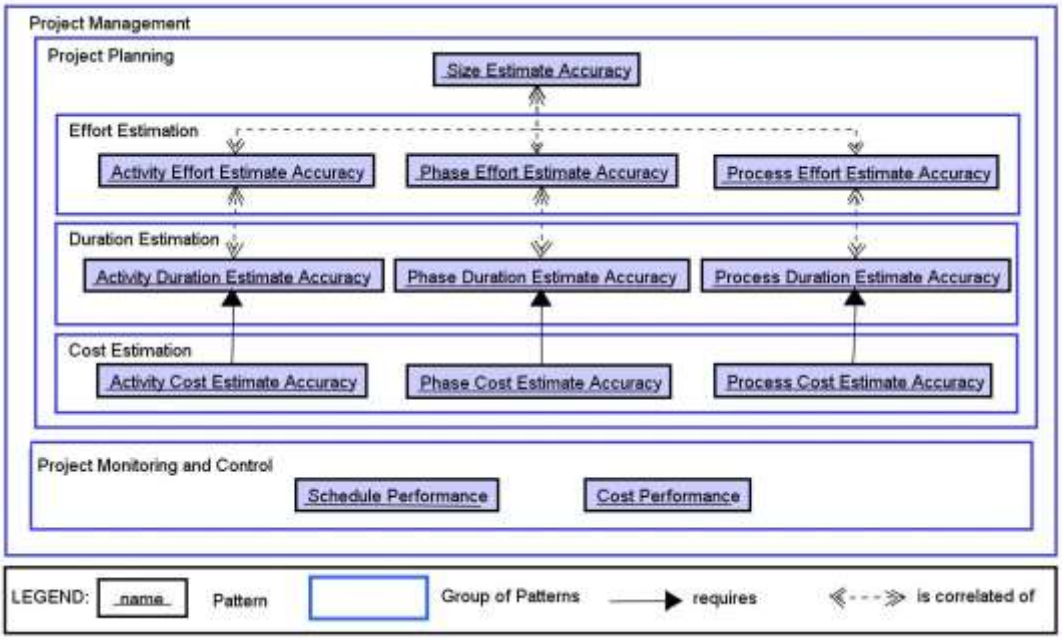

Figure 1 – Structural Model of the Project Management pattern group.

The structural model of the Project Management process is composed of two subgroups, one related to the *Project Planning* sub-process and the other related to the *Project Monitoring and Control* sub-process. In the *Project Planning* group, there are subgroups for patterns related to effort estimations, duration estimations and cost estimations. For example, the *Activity Cost Estimate Accuracy* pattern has a dependency relation with the *Activity Duration Estimate Accuracy* pattern, since before estimating the activities costs it is necessary to estimate their duration. There are, also, correlations between patterns. For instance, the *Activity Duration Estimate Accuracy* is correlated to the *Activity Effort Estimate Accuracy* pattern, because there is a relation between effort and duration of activities, but to determine the duration of an activity it is not necessary to determine the effort required to perform the activity beforehand.

Figure 2 shows the structural model containing patterns related to the Coding process.

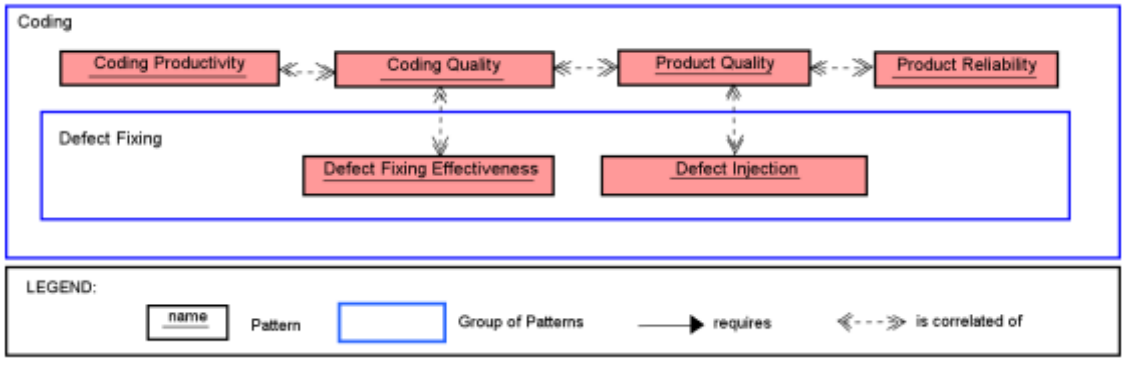

Figure 2 – Structural Model of the Coding pattern group.

There are correlations among the patterns related to the *Coding* process. For example, the *Product Quality* pattern is correlated to the *Coding Quality* pattern, since the quality of the coding process can impact the quality of the product (a bad quality process should result in a bad quality product), but applying the *Product Quality* pattern does not depend on the *Coding Quality* pattern (so there is no dependency relation between them). The structural model regarding Coding has a subgroup containing patterns related to *Defect fixing*.

Figure 3 shows the structural model containing patterns related to the *Tests* process.

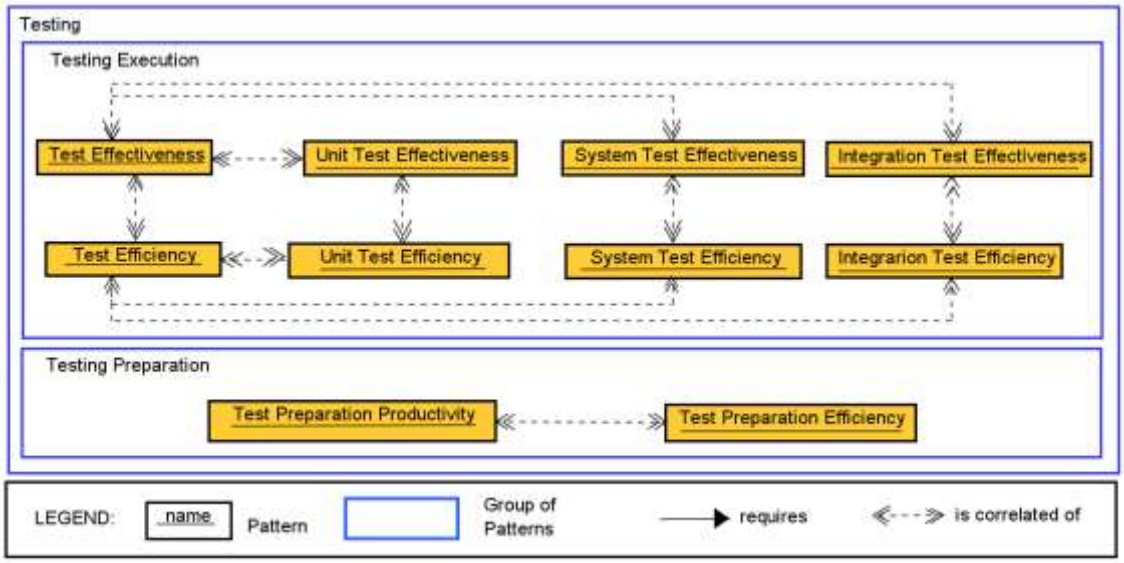

Figure 3 – Structural Model of Tests pattern group.

Similar to patterns related to *Coding*, there are only correlations between patterns related to *Tests*. For example, *Test Effectiveness* is correlated to *Test Efficiency*, since improvements in the effectiveness of the tests can have impact on their efficiency (more effective tests can demand more effort). The structural model related to Tests has two subgroups, one related to the Tests Preparation sub-process, which refers to the preparation of procedures or test cases, and the other one related to the Test Execution sub-process, which deals with aspects related to the test execution itself.

3. MePPLa Behavioral Model

The behavioral model describes the process of applying the patterns. In the used notation, the patterns are represented by rounded rectangles with labels. The pattern groups are represented by regions delimited by straight lines with thick blue borders and curved connections between the lines. The input points, that is, points where the application of the patterns can be started, are represented by solid circles. The decision

nodes (represented by diamonds) are used to represent alternative paths. Arrows represent the path the user must follow in the pattern language application. The doubly circled solid circle is used to indicate the end of the process of pattern application.

The behavioral model has two formats: black box format, which provides the general overview of the pattern language, and the detailed format, which provides the detailed behavioral overview of the pattern language, containing the flows which guide the patterns application.

Both model formats should be understood as a process to be followed step by step, from an entry point to an end point. The black box format is composed of groups and decision nodes which must be followed by the user from the entry point to the end point.

As well as the structural model, the patterns are grouped according to the processes and sub-processes to which they relate to. Therefore, in the black box format it is possible to visualize the processes considered in the pattern language. As its name suggests, in the black box format it is not possible to visualize the patterns and existing flows inside each group. Figure 4 presents the black box format of the behavioral model of MePPLa.

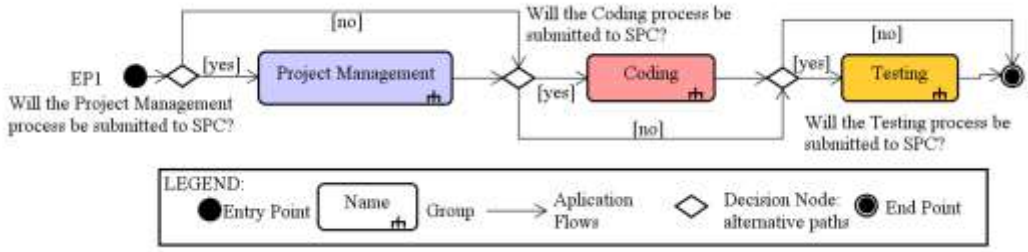

Figure 4 – Blackbox format of the behavioral model

The detailed behavioral model shows the groups' internal content. For each process group, subgroups are utilized to group patterns related to the sub-processes. This model presents the flows which guide the patterns application. It is important to note that the behavioral model is consistent with the structural model, thus, they both have the same groups, subgroups and patterns. Furthermore, the behavioral model respects the relations established in the structural model. For instance, in the behavioral model regarding Project Management, the flow only allows using the *Cost Estimate Accuracy* pattern if the *Duration Esimate Accuracy* pattern was used before, since there is a dependency relation between these patterns in the structural model of Project Management.

For each pattern group (process) present in Figure 4 there is a detailed behavioral model. In each model, general measurement goals are used to indicate entry points and specific measurement goals are used to support decision-making. For example, to the Project Management group, the *Improve project planning and estimating* goal is used to indicate

the entry point for the Project Planning subgroup. In other words, the user should follow the subgroup if s/he wishes to *Improve project planning and estimating*. Specific goals, such as *Improve size estimations* are used in decision nodes to lead to the application or not of a given pattern. For instance, if it is desired to reach the *Improve size estimations* goal, the decision node leads to the *Size Estimate Accuracy* pattern. Otherwise, another flow should be followed. The user must follow the flows in the behavioral model until an end point is reached.

The figures 5, 6 and 7 present, respectively, the behavioral model of the Project Management, Coding and Testing groups.

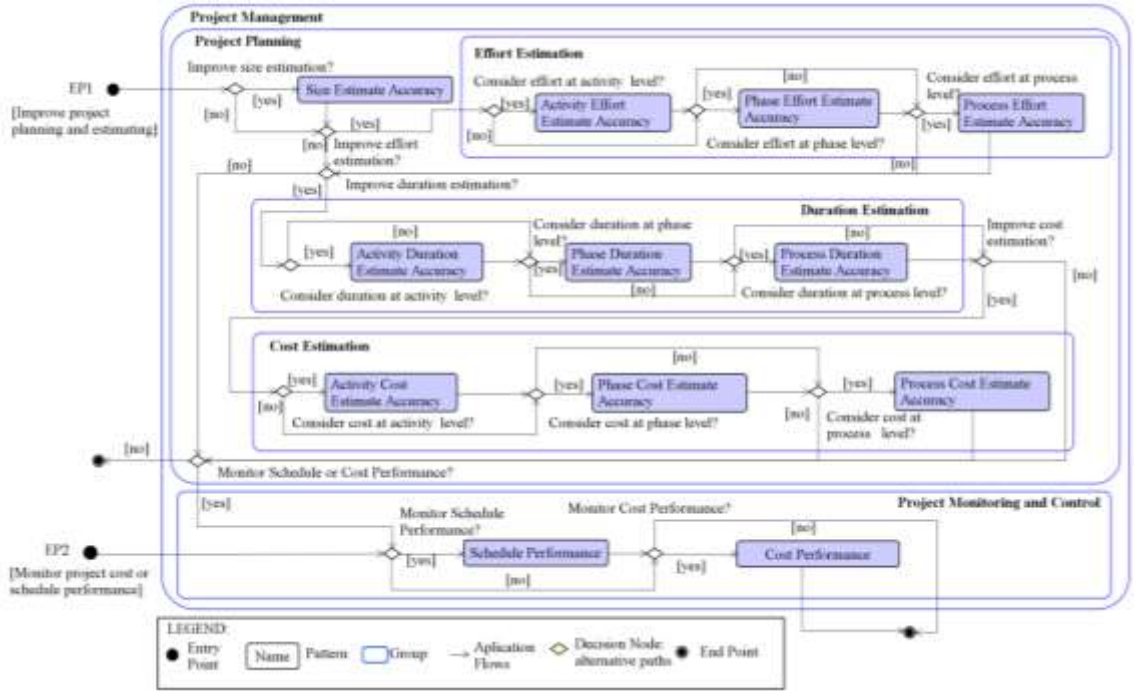

Figure 5– Behavioral Model of Project Management group.

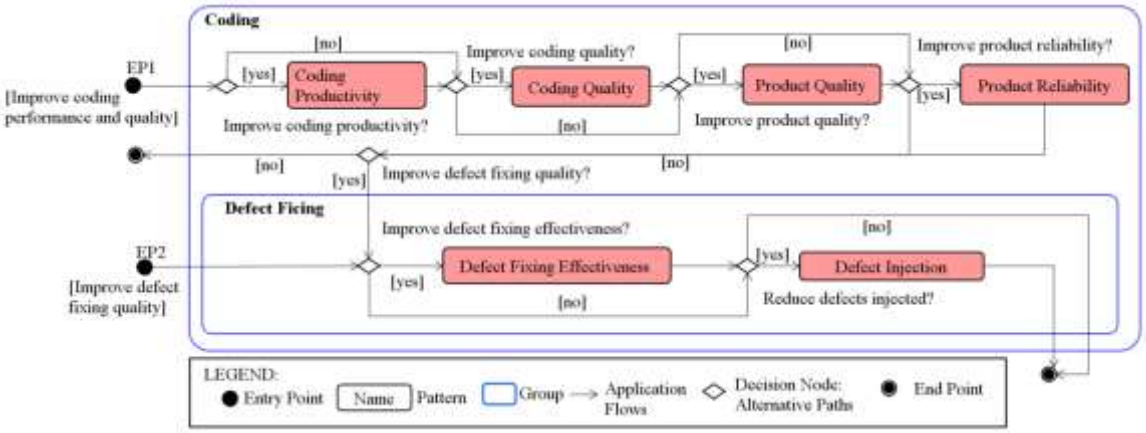

Figure 6 – Behavioral Model of Coding group.

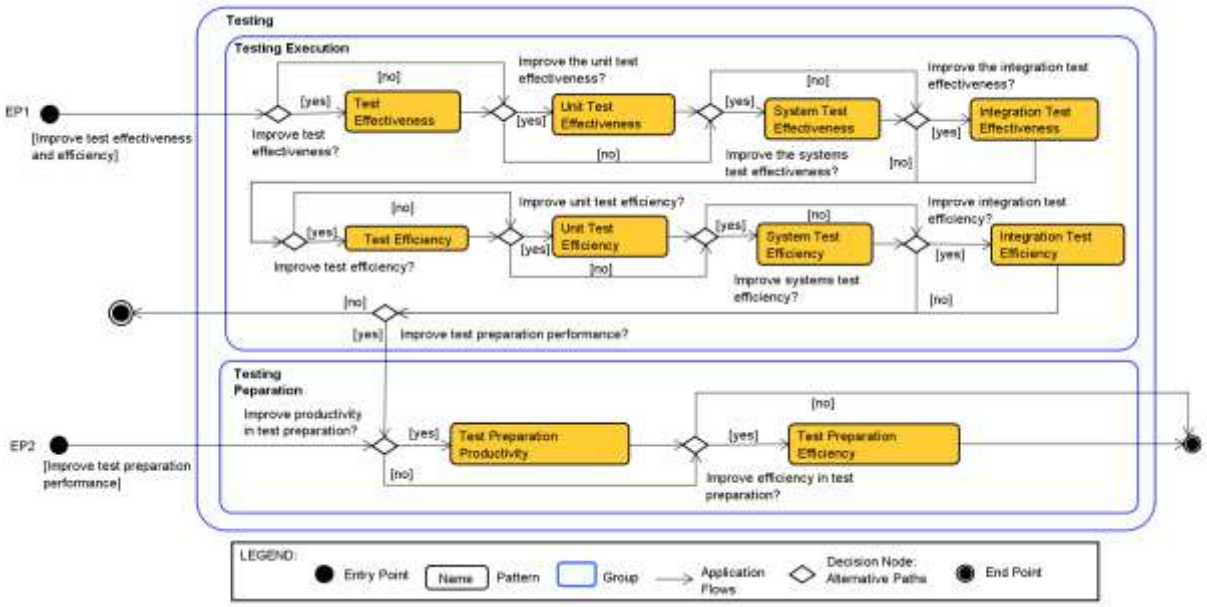

Figure 7 – Behavioral Model of Tests group.

In the next section, we present the description of each pattern of MePPLa. It is worth saying that MePPLa is supported by a computational tool available at http://dev.nemo.inf.ufes.br:8180/MPPL/login.faces. Thus, although this document contains a complete specification of MePPLa, the use of the pattern language is facilitated by the computational tool.

4. Measurement Planning Patterns

The description of each pattern of MePPLa includes the following information:

- **Name**: indicates the name of the pattern.
- **Process/Sub-process**: indicates the process/sub-process which the pattern relates to.
- **Goal**: indicates the measurement goal considered in the pattern.
- **Information Needs**: questions which indicate information needs which allow monitoring the measurement goal. It represents the "Question" item of the GQM model (*Goal-Question-Metric).*
- **Measures**: measures able to answer the information needs.
- **Operational Definition of Measure**: a detailed definition of the measure which provides information about its collection and analysis.
- **Related Patterns**: patterns which are related to the defined pattern.

In the pattern descriptions, the texts in *italic* and between << >> are comments which should be taken in consideration when the pattern is applied (the information must be filled by the user when the pattern is used).

Every pattern has measures which Procedure of Measurement Analysis is indicated as "Standard measurement analysis procedure for SPC use in the context of processes maturity models". This procedure guides the analysis of data for SPC in the context of maturity models such as CMMI and MR-MPS-SW and is described in Table 2.

Table 2 – Standard measurement analysis procedure for SPC use in the context of processes maturity models

For process behavior analysis (organizational context):

- Represent in a control chart the values collected for the measure in several projects.
- Obtain the process control limits and analyze the process behavior:
  - *(i)* If the values pass the stability tests, the process is then deemed stable and a baseline can be established. Stability tests (WHEELER and CHAMBERS, 2010):
    - Test 1: There is at least one point outside 3σ.
    - Test 2: There are at least two out of three successive points at the same side and at more than 2σ from the central limit.
    - Test 3: There are at least four out of five successive points at the same side and at more than 1σ from the central limit.
    - Test 4: There are at least eight successive points at the same side.
  - *(ii)* If the values do not pass the stability tests, the process is unstable. It is necessary to investigate the special causes, identify corrective actions and execute them.

For quantitative project management (project context):

- Represent in a control chart values collected for the measure in the project.
- Analyze the process behavior considering the organizational behavior expected for it (using the process baseline as reference).
  - *(i)* If the values pass the stability tests considering the process baseline as reference, then the process behaved according to the behavior expected for it in the organization.
  - *(ii)* If the values do not pass the stability tests considering the process baseline as reference, then the process did not behave according to the behavior expected for it in the organization. It is necessary to investigate the causes, identify corrective actions and execute them.

4.1 Project Management Group

Size Estimate Accuracy

Name: Size Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve size estimation
Information Needs: What is the accuracy of size estimations?
Measures: Size Estimate Accuracy, Actual Size, Estimated Size.
Operational Definition of Measures:

Derived Measure	Size Estimation Accuracy
Mnemonic	SEA
Description	Measure used to quantify the product size estimate accuracy, which is given by the ratio between the actual size and estimated size.
Measurable Measurable Entity	Project Planning Sub-process
Measurable Property	Size estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	SEA = (AS/ES)
Measurement Procedure	Calculate the size estimate accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for parts of the product (software units, modules, etc.), not only for the final product of the project. The measurement should be carried out when the referred part of the product is finished, or a frequency can be stablished (e.g., weekly or biweekly) so the measurement can be carried out for the finished parts by that time.>>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider. >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Actual Size
Mnemonic	AS
Description	Measure which quantifies the product actual size.
Measurable Measurable Entity	Software
Measurable Property	Actual size
Scale	Positive real numbers (zero excluded)
Measurement Unit	*<<KSLOC or FP>>*
Formula	-
Measurement Procedure	Obtain the *<<number of source-code lines or function points >>* of the product.
Base Measure 2	Estimated Size
Mnemonic	ES
Description	Measure which quantifies the product estimated size.
Measurable Entity	Software
Measurable Property	Estimated size
Scale	Positive real numbers (zero excluded)
Measurement Unit	*<<KSLOC or FP>>*
Formula	-
Measurement Procedure	Obtain the *<<number of source-code lines or function points >>* estimated for the product.

Related Patterns: Activity Effort Estimate Accuracy, Phase Effort Estimate Accuracy, Process Effort Estimate Accuracy.

Activity Effort Estimate Accuracy

Name: Activity Effort Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve activity effort estimation
Information Needs: What is the accuracy of activity effort estimations?
Measures: Activity Effort Estimate Accuracy, Activity Actual Effort, Activity Estimated Effort.
Operational Definition of Measures:

Derived Measure	Activity Effort Estimate Accuracy
Mnemonic	AEEA
Description	Measurement used to quantify the activity effort estimate accuracy, which is given by the ratio between activity actual effort and the estimated effort for the activity.
Measurable Entity	Project Planning Sub-process
Measurable Property	Effort estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	AEEA = (AAE / AEE)
Measurement Procedure	Calculate the activity effort estimate accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each performed activity, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the activities performed by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Activity Actual Effort
Mnemonic	AAE
Description	Measure which quantifies the activity actual effort.
Measurable Entity	Activity
Measurable Property	Actual effort
Scale	Positive real numbers (zero excluded)
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the actual activity effort.
Base Measure 2	Activity Estimated Effort
Mnemonic	AEE
Description	Measure which quantifies the activity estimated effort.
Measurable Entity	Activity
Measurable Property	Estimated effort
Scale	Positive real numbers (zero excluded)
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the estimated activity effort from the project baseline.

Related Patterns: Size Estimate Accuracy, Activity Duration Estimate Accuracy.

Phase Effort Estimate Accuracy

Name: Phase Effort Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve phase effort estimation
Information Needs: What is the accuracy of phase effort estimating?
Measures: Phase Effort Estimate Accuracy, Phase Actual Effort, Phase Estimated Effort.
Operational Definition of Measures:

Derived Measure	Phase Effort Estimate Accuracy
Mnemonic	PhEEA
Description	Measure used to quantify the phase effort estimate accuracy, which is given by the ratio between the phase actual effort and the phase estimated effort.
Measurable Entity	Project Planning Sub-process
Measurable Property	Effort estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	PhEEA = (PhAE / PhEE)
Measurement Procedure	Calculate the phase effort estimation accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each phase, when it is finished, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the phases finished by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Phase Actual Effort
Mnemonic	PhAE
Description	Measure which quantifies the phase actual effort.
Measurable Entity	Project Planning Sub-process
Measurable Property	Actual effort
Scale	Positive real numbers (zero excluded)
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the actual phase effort.
Base Measure 2	Phase Estimated Effort
Mnemonic	PhEE
Description	Measure which quantifies the estimated effort for the phase.
Measurable Entity	Project Planning Sub-process
Measurable Property	Estimated effort
Scale	Positive real numbers (zero excluded)
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the phase estimated effort from the project baseline.

Related Patterns: Size Estimate Accuracy, Phase Duration Estimate Accuracy.

Process Effort Estimate Accuracy

Name: Process Effort Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve processes effort estimation
Information Needs: What is the accuracy of process effort estimations?
Measures: Process Effort Estimate Accuracy, Process Actual Effort, Process Estimated Effort.
Operational Definition of Measures:

Derived Measure	Process Effort Estimate Accuracy
Mnemonic	PEEA
Description	Measure used to quantify the process effort estimate accuracy, which is given by the ratio between process actual effort and the estimated effort for the process.
Measurable Entity	Project Planning Sub-process
Measurable Property	Effort estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	PEEA = (PAE/ PEE)
Measurement Procedure	Calculate the process effort estimation accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each process, when it is finished, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the processes finished by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Process Actual Effort
Mnemonic	PAE
Description	Measure which quantifies the process actual effort.
Measurable Entity	Process
Measurable Property	Actual effort
Scale	Positive real numbers (zero excluded)
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the process actual effort
Base Measure 2	Process Estimated Effort
Mnemonic	PEE
Description	Measure which quantifies the process estimated effort.
Measurable Entity	Process
Measurable Property	Estimated effort
Scale	Positive real numbers (zero excluded)
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the process estimated effort from the project baseline.

Related Patterns: Size Estimate Accuracy, Process Duration Estimate Accuracy.

Activity Duration Estimate Accuracy

Name: Activity Duration Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve activity duration estimation
Information Needs: What is the accuracy of activity duration estimations?
Measures: Activity Duration Estimate Accuracy, Activity Actual Duration, Activity Estimated Duration.
Operational Definition of Measures:

Derived Measure	
Mnemonic	ADEA
Description	Measure used to quantify the activity duration estimate accuracy, which is given by the ratio between activity actual duration and the estimated duration for the activity.
Measurable Entity	Project Planning Sub-process
Measurable Property	Effort estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	ADEA = (AAD / AED)
Measurement Procedure	Calculate the activity duration estimate accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each performed activity, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the activities performed by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Activity Actual Duration
Mnemonic	AAD
Description	Measure which quantifies the activity actual duration.
Measurable Entity	Activity
Measurable Property	Actual duration
Scale	Positive real numbers (zero excluded)
Measurement Unit	*<<A time measurement unit must be defined, such as minutes, hours or days. >>*
Formula	-
Measurement Procedure	Obtain the actual activity duration.
Base Measure 2	Activity Estimated Duration
Mnemonic	AED
Description	Measure which quantifies the estimated duration of the activity up until the moment of measurement.
Measurable Entity	Activity
Measurable Property	Estimated duration
Scale	Positive real numbers (zero excluded)
Measurement Unit	*<<A measurement unit of time must be defined, such as minutes, hours or days.>>*
Formula	-
Measurement Procedure	Obtain the estimated duration of the activity from the project baseline.

Related Patterns: Activity Effort Estimate Accuracy.

Phase Duration Estimate Accuracy

Nome: Phase Duration Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve phase duration estimation
Information Needs: What is the accuracy of phase duration estimations?
Measures: Phase Duration Estimate Accuracy, Phase Actual Duration, Phase Estimated Duration.
Operational Definition of Measures:

Derived Measure	Phase Duration Estimation Accuracy
Mnemonic	PhDEA
Description	Measure used to quantify the phase duration estimate accuracy, which is given by the ratio between phase actual duration and the estimated duration for the phase.
Measurable Entity	Project Planning Sub-process
Measurable Property	Duration estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	PhDEA = (PhAD/ PhED)
Measurement Procedure	Calculate the phase duration estimate accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each phase, when it is finished, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the phases finished by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Phase Actual Duration
Mnemonic	PhAD
Description	Measure which quantifies the phase actual duration.
Measurable Entity	Phase
Measurable Property	Actual duration
Scale	Positive real numbers (zero excluded)
Measurement Unit	*<<A time measurement unit must be defined, such as minutes, hours or days. >>*
Formula	-
Measurement Procedure	Obtain the phase actual duration.
Base Measure 2	Phase Estimated Duration
Mnemonic	PhED
Description	Measure which quantifies the estimated duration of the phase.
Measurable Entity	Phase
Measurable Property	Estimated duration
Scale	Positive real numbers (zero excluded)
Measurement Unit	*<<A time measurement unit must be defined, such as minutes, hours or days. >>*
Formula	-
Measurement Procedure	Obtain the estimated duration of the phase from the project baseline.

Related Patterns: Phase Effort Estimate Accuracy.

Process Duration Estimate Accuracy

Nome: Process Duration Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve process duration estimation
Information Needs: What is the accuracy of process duration estimations?
Measures: Process Duration Estimate Accuracy, Process Actual Duration, Process Estimated Duration.
Operational Definition of Measures:

Derived Measure	Process Duration Estimation Accuracy
Mnemonic	PDEA
Description	Measure used to quantify the process duration estimate accuracy, which is given by the ratio between process actual duration and the estimated duration of the process.
Measurable Entity	Project Planning Sub-process
Measurable Property	Duration estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	PDEA = (PAD/ PED)
Measurement Procedure	Calculate the process duration estimate accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each process, when it is finished, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the processes finished by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Process Actual Duration
Mnemonic	PAD
Description	Measure which quantifies the process actual duration.
Measurable Entity	Process
Measurable Property	Actual duration
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A time measurement unit must be defined, such as minutes, hours or days.>>*
Formula	-
Measurement Procedure	Obtain the process actual duration until the measurement.
Base Measure 2	Process Estimated Duration
Mnemonic	PED
Description	Measure which quantifies the estimated duration of the process.
Measurable Entity	Process
Measurable Property	Estimated duration
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A time measurement unit must be defined, such as minutes, hours or days.>>*
Formula	-
Measurement Procedure	Obtain the estimated duration of the process from the project baseline.

Related Patterns: Process Effort Estimate Accuracy.

Activity Cost Estimate Accuracy

Name: Activity Cost Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve activity cost estimation
Information Needs: What is the accuracy of activity cost estimations?
Measures: Activity Cost Estimate Accuracy, Activity Actual Cost, Activity Estimated Cost.
Operational Definition of Measures:

Derived Measure	Activity Cost Estimate Accuracy
Mnemonic	ACEA
Description	Measure used to quantify the activity cost estimate accuracy, which is given by the ratio between activity actual cost and the estimated cost of the activity.
Measurable Entity	Project Planning Sub-process
Measurable Property	Cost estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	ACEA = (AAC/ EAC)
Measurement Procedure	Calculate the activity cost estimate accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each performed activity, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the activities performed by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Activity Actual Cost
Mnemonic	AAC
Description	Measure which quantifies the activity actual cost.
Measurable Entity	Activity
Measurable Property	Actual cost
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain the activity actual cost.
Base Measure 2	Activity Estimated Cost
Mnemonic	AEC
Description	Measure which quantifies the estimated cost of the activity.
Measurable Entity	Activity
Measurable Property	Estimated cost
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain the estimated cost of the activity from the project baseline.

Related Patterns: Activity Duration Estimate Accuracy.

Phase Cost Estimate Accuracy

Name: Phase Cost Estimation Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve phase cost estimation
Information Needs: What is the accuracy of phase cost estimations?
Measures: Phase Cost Estimate Accuracy, Phase Actual Cost, Phase Estimated Cost.
Operational Definition of Measures:

Derived Measure	Phase Cost Estimate Accuracy
Mnemonic	PhCEA
Description	Measure used to quantify the phase cost estimate accuracy, that is, the ratio between phase actual cost and the estimated cost of the phase.
Measurable Entity	Project Planning Sub-process
Measurable Property	Cost estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	PhCEA = (PhAC / PhEC)
Measurement Procedure	Calculate the phase cost estimate accuracy using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each phase, when it is finished, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the phases finished by then.>>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<< Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Phase Actual Cost
Mnemonic	PhAC
Description	Measure which quantifies the phase actual cost.
Measurable Entity	Phase
Measurable Property	Actual cost
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain the phase actual cost.
Base Measure 2	Phase Estimated Cost
Mnemonic	PhEC
Description	Measure which quantifies the estimated cost of the phase.
Measurable Entity	Phase
Measurable Property	Estimated cost
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain the estimated cost of the phase from the project baseline.

Related Patterns: Phase Duration Estimate Accuracy.

Process Cost Estimate Accuracy

Name: Process Cost Estimate Accuracy
Process/Sub-process: Project Management/Project Planning
Goal: Improve process cost estimation
Information Needs: What is the accuracy of process cost estimations?
Measures: Process Cost Estimate Accuracy, Process Actual Cost, Process Estimated Cost.
Operational Definition of Measures:

Derived Measure	Process Cost Estimate Accuracy
Mnemonic	PCEA
Description	Measure used to quantify the process cost estimate accuracy, which is given by the ratio between process actual cost and the process estimated cost.
Measurable Entity	Project Planning Sub-process
Measurable Property	Cost estimation effectiveness
Scale	Positive real numbers (zero excluded), accurate to two decimal places.
Measurement Unit	-
Formula	PCEA = (PAC/ PEC)
Measurement Procedure	Calculate the accuracy of process cost estimations using the formula for calculating the measure.
Measurement Periodicity	*<<The measurement should be carried out for each process, when it is finished, or a frequency (e.g., weekly or biweekly) can be established so the measurements can be carried out for the processes finished by then. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process (e.g., monitor the project estimates) or of an organizational process (e.g., evaluate the project management process).>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Process Actual Cost
Mnemonic	PAC
Description	Measure which quantifies the process actual cost.
Measurable Entity	Process
Measurable Property	Actual cost
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain the process actual cost.
Base Measure 2	Process Estimated Cost
Mnemonic	PEC
Description	Measure which quantifies the process estimated cost.
Measurable Entity	Process
Measurable Property	Estimated cost
Scale	Positive real numbers (zero excluded).
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain the process estimated cost from the project baseline.

Related Patterns: Process Duration Estimate Accuracy.

Schedule Performance

Name: Schedule Performance
Process/Sub-process: Project Management/Project Monitoring and Control
Goal: Monitor schedule performance
Information Needs: What is the performance of the project schedule?
Measures: Schedule Performance Index, Earned Value, Planned Value.
Operational Definition of Measures:

Derived Measurement	Schedule Performance Index
Mnemonic	SPI
Description	Measure used to quantify the project schedule performance, which is given by the ratio between the earned value and the planned value at a given moment of the project (e.g., the measurement date).
Measurable Entity	Project Monitoring and Control Sub-process
Measurable Property	Schedule performance
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	-
Formula	SPI = (EV/ PV)
Measurement Procedure	Calculate schedule performance index using the formula for calculating the measure, considering the same date for both base measures in the formula.
Measurement Periodicity	*<<A frequency (e.g., weekly or biweekly) should be established to data collection. The frequency should enable several measurements during the same project, so it is possible to obtain amount of data suitable for SPC. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Earned Value
Mnemonic	EV
Description	Measure that quantifies the cost planned for the work performed in the project until a given moment of the project (e.g., until the measurement date).
Measurable Entity	Project
Measurable Property	Earned value
Scale	Positive real numbers.
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain from the project baseline the cost planned for the work performed in the project until a given moment of the project (e.g., until the measurement date).
Base Measure 2	Planned Value
Mnemonic	PV
Description	Measure that quantifies the planned cost for the work planned to be performed in the project until a given moment of the project (e.g., until the measurement date).
Measurable Entity	Project
Measurable Property	Planned value
Scale	Positive real numbers.
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain from the project baseline the cost planned for the work planned to be performed in the project until a given moment of the project (e.g., until the measurement date).

Related Patterns: -

Cost Performance

Name: Cost Performance
Process/Sub-process: Project Management/Project Monitoring and Control
Goal: Monitor cost performance.
Information Needs: What is the performance of the project cost?
Measures: Cost Performance Index, Earned Value, Planned Value.
Operational Definition of Measures:

Derived Measure	Cost Performance Index
Mnemonic	CPI
Description	Measure used to quantify the project cost performance, which is given by the ratio between the earned value and the actual cost.
Measurable Entity	Project Monitoring and Control Sub-process
Measurable Property	Cost performance
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	-
Formula	CPI = (EV/ AC)
Measurement Procedure	Calculate the cost performance index using the formula for calculating the measure, considering the same date for both base measures in the formula.
Measurement Periodicity	*<<A frequency (e.g., weekly or biweekly) should be established to data collection. The frequency should enable several measurements during the same project, so it is possible to obtain amount of data suitable for SPC. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measurement 1	Earned Value
Mnemonic	EV
Description	Measure that quantifies the cost planned for the work performed in the project until a given moment of the project (e.g., until the measurement date).
Measurable Entity	Project
Measurable Property	Earned value
Scale	Positive real numbers.
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain from the project baseline the cost planned for the work performed in the project until a given moment of the project (e.g., until the measurement date).
Base Measurement 2	Actual Cost
Mnemonic	AC
Description	Measure that quantifies the actual cost for the work performed in the project until a given moment (e.g., until the measurement date).
Measurable Entity	Project
Measurable Property	Actual cost
Scale	Positive real numbers.
Measurement Unit	*<<A currency unit must be defined, such as BRL, USD or EUR.>>*
Formula	-
Measurement Procedure	Obtain the actual cost for the work performed in the project until a given moment (e.g., until the measurement date).

Related Patterns: -

4.2 Coding Group

Coding Productivity

Name: Coding Productivity
Process/Sub-process: Coding
Goal: Improve coding productivity.
Information Needs: What is the coding productivity?
Measures: Coding Productivity, Coding Effort, Product Size.
Operational Definition of Measures:

Derived Measure	Coding Productivity
Mnemonic	CP
Description	Measure used to quantify the coding productivity, which is given by the ratio between the coding effort and the product size.
Measurable Entity	Coding Process
Measurable Property	Productivity
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	man-hour/<<*KSLOC or FP*>>
Formula	CP = (CE/PS)
Measurement Procedure	Calculate the coding productivity using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	<<*A frequency for data collection can be established (e.g., weekly or biweekly) and the measurement is performed considering the product produced in the referred period. Alternatively, data collection can be performed when a certain portion of the product is produced (e.g., a unit or module.* >>
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	<<*Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.*>>
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measure 1	Coding Effort
Mnemonic	CE
Description	Measure which quantifies the effort spent when coding a software (or a piece of it).
Measurable Entity	Coding Process
Measurable Property	Effort
Scale	Positive real numbers, accurate to two decimal places
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the effort spent in coding the software.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points* >> of the product to be considered.

Related Patterns: Coding Quality.

Coding Quality

Name: Coding Quality
Process/Sub-process: Coding
Goal: Improve coding quality.
Information Needs: What is the rework due coding errors?
Measures: Rework Rate, Time Spent due to Rework, Product Size.
Operational Definition of Measures:

Derived Measure	Rework Rate
Mnemonic	RR
Description	Measurement used to quantify the rework rate in coding, which is given by the ratio between time spent due to rework and the size of the referred product.
Measurable Entity	Coding Process
Measurable Property	Process quality
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	*<<hours/(KSLOC or FP>>*
Formula	RR = (TSR/ PS)
Measurement Procedure	Calculate the rework rate in coding using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	*<<A frequency (e.g., weekly or biweekly) should be established to data collection. The frequency should enable several measurements during the same project, so it is possible to obtain amount of data suitable for SPC. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Time Spent due to Rework
Mnemonic	TSR
Description	Measure which quantifies the time spent on rework in coding.
Measurable Entity	Coding Process
Measurable Property	Time spent on rework
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Hours
Formula	-
Measurement Procedure	Obtain the quantity of hours spent on rework in coding.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers.
Measurement Unit	*<<KSLOC or FP>>*
Formula	-
Measurement Procedure	Obtain the *<<number of source-code lines or function points>>* of the product to be considered.

Related Patterns: Coding Productivity, Defect Injection.

Product Quality

Name: Product Quality
Process/Sub-process: Coding
Goal: Improve product quality
Information Needs: What is the defect density detected in the product?
Measures: Defect Density, Number of Defects, Product Size.
Operational Definition of Measures:

Derived Measure	Defect Density
Mnemonic	DD
Description	Measure used to quantify the defect density, which is given by the ratio between number of defects and the referred product size.
Measurable Entity	Coding Process
Measurable Property	Product quality
Scale	Positive real numbers, accurate to two decimal places
Measurement Unit	Defects/<<*KSLOC or FP*>>
Formula	DD = (ND/PS)
Measurement Procedure	Calculate the defect density using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	<<*A frequency for data collection can be established (e.g., weekly or biweekly) and the measurement should be performed considering the product produced in the referred period. Alternatively, data collection can be performed referring to a certain portion of the product (e.g., a unit or module).* >>
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	<<*Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.*>>
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measure 1	Number of Defects
Mnemonic	ND
Description	Measure which quantifies the number of defects in a product.
Measurable Entity	Software
Measurable Property	Product quality
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of defects in the product.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points*>> of the product to be considered.

Related Patterns: Coding Quality, Defect Fixing Effectiveness, Product Reliability.

Product Reliability

Name: Product Reliability
Process/Sub-process: Coding
Goal: Improve product reliability.
Information Needs: What is the average time between product failures?
Measures: Average Time between Failures, Time between Failures, Number of Failures.
Operational Definition of Measures:

Derived Measure	Average Time between Failures due Coding problems
Mnemonic	ATF
Description	Measure used to quantify the average time between two successive occurrences of failures due coding after the software has been delivered.
Measurable Entity	Coding Process
Measurable Property	Reliability
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	*<<Indicate a measurement unit of time (e.g., hour or day)>>*
Formula	ATF = $((TF_1 + TF_2 + \ldots + TF_n)/(NF - 1))$
Measurement Procedure	Calculate the average time between failures using the measure calculation formula, considering the same product (or portion of product) for the base measures of the formula.
Measurement Periodicity	*<<A frequency (e.g., weekly or biweekly) should be established to data collection. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.>>*
Measurement Analysis Procedure	*<< Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Time between Failures
Mnemonic	TF
Description	Measure which quantifies the time between two consecutive failures of the product delivered to the client.
Measurable Entity	Software
Measurable Property	Product quality
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	*<<Indicate a measurement unit of time (e.g., hour or day)>>*
Formula	-
Measurement Procedure	Obtain the elapsed time between two failures reported by the client referring to the delivered product.
Base Measure 2	Number of Failures
Mnemonic	NF
Description	Measure which quantifies the number of failures reported by the client referring to the delivered product.
Measurable Entity	Software
Measurable Property	Product quality
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of reported failures by the client referring to the delivered product.

Related Patterns: Product Quality

Defect Fixing Effectiveness

Name: Defect Fixing Effectiveness
Process/Sub-process: Coding / Defect Fixing
Goal: Improve defect fixing effectiveness.
Information Needs: What is the defect fixing effectiveness?
Measures: Defect Fixing Effectiveness, Number of Fixed Defects, Number of Defects.
Operational Definition of Measures:

Derived Measure	Defect Fixing Effectiveness
Mnemonic	DFE
Description	Measure used to quantify the defect fixing effectiveness, which is given by the ratio between the number of fixed defects and the number of detected defects.
Measurable Entity	Defect Fixing Sub-process
Measurable Property	Effectiveness
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	-
Formula	DFE = (NFD / ND)
Measurement Procedure	Calculate the defect fixing effectiveness using the measure calculation formula, considering the same product (or portion of product) for both measures in the formula.
Measurement Periodicity	*<<A frequency (e.g., weekly or biweekly) should be established to data collection. The frequency should enable several measurements during the same project, so it is possible to obtain amount of data suitable for SPC. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Number of Fixed Defects
Mnemonic	NFD
Description	Measure which quantifies the number of defects fixed in a product.
Measurable Entity	Defects Fixing Sub-process
Measurable Property	Performance
Scale	Positive real numbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects which were fixed.
Base Measure 2	Number of Defects
Mnemonic	ND
Description	Measure which quantifies the number of defects in a product.
Measurable Entity	Software
Measurable Property	Product quality
Scale	Positive real numbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of defects in the product.

Related Patterns: Product Quality

Defect Injection

Name: Defect Injection
Process/Sub-process: Coding / Defect Fixing
Goal: Reduce injected defects
Information Needs: What is the defect injection rate?
Measures: Defect Injection Rate, Number of Injected Defects Number, Product Size.
Operational Definition of Measures:

Derived Measure	Defect Injection Rate
Mnemonic	DIR
Description	Measure used to quantify the rate of injected defects, which is given by the ratio between the number of defects injected in a product and the product size.
Measurable Entity	Defect Fixing Sub-process
Measurable Property	Efficacy
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects/*<<KSLOC or FP>>*
Formula	DIR = (NID /PS)
Measurement Procedure	Calculate the defects injection rate using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	*<<A frequency (e.g., weekly or biweekly) should be established to data collection. The frequency should enable several measurements during the same project, so it is possible to obtain amount of data suitable for SPC. >>*
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	*<<Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.>>*
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Number of Injected Defects
Mnemonic	NID
Description	Measure which quantifies the number of injected defects in a product.
Measurable Entity	Defects Fixing Sub-process
Measurable Property	Efficacy
Scale	Positive real numbers.
Measurement Unit	Defects
Formula	-
Measurement Procedure	Obtain the number of defects injected in the product due to fixing defects previously detected.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers.
Measurement Unit	*<<KSLOC or FP>>*
Formula	-
Measurement Procedure	Obtain the *<<number of source-code lines or function points>>* of the product to be considered.

Related Patterns: Coding Quality.

4.3 Tests Group

Test Effectiveness

Name: Test Effectiveness
Process/Sub-process: Testing / Testing Execution
Goal: Improve test effectiveness
Information Needs: What is the effectiveness of the test?
Measures: Detected Defects Density, Number of Detected Defects, Product Size, Delivered Defects Density, Number of Delivered Defects
Operational Definition of Measures:

Derived Measurement	Detected Defect Density
Mnemonic	DDD
Description	Measure used to quantify the density of detected defects, which is given by the ratio between number of detected defects and the size of the tested product.
Measurable Entity	Testing Process
Measurable Property	Performance
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects/*<<KSLOC or FP>>*
Formula	DDD = (NDD/PS)
Measurement Procedure	Calculate the density of detected defects using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each test execution.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	At the end of the test execution.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Number of Detected Defects
Mnemonic	NDD
Description	Measure which quantifies the number of defects detected in the test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects in the test.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers
Measurement Unit	*<<KSLOC or FP>>*
Formula	-
Measurement Procedure	Obtain the *<<number of source-code lines or function points>>* of the product to be considered.

Derived Measure	Delivered Defects Density
Mnemonic	DelDD
Description	Measure used to quantify the density of delivered defects, which is given by the ratio between the number of delivered defects and the size of the delivered product.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficacy

Scale	Positive real numbers accurate to two decimal places
Measurement Unit	Defects/<<*KSLOC or FP*>>
Formula	DelDD = (NDelD/PS)
Measurement Procedure	Calculate the density of delivered defects using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	<<*A frequency for data collection can be established (e.g., weekly or biweekly) and the measurement should be performed considering the product delivered in the referred period. Alternatively, data collection can be performed referring to a certain portion of the delivered product (e.g., a unit or module).* >>
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	<<*Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.*>>
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measure 1	Number of Delivered Defects
Mnemonic	NDelD
Description	Measuret which quantifies the number of defects delivered to the client.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficacy
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of the delivered defects reported by the client during the period.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points* >> of the product to be considered.

Related Patterns: Unit Test Effectiveness, System Test Effectiveness, Integration Test Effectiveness, Test Efficiency.

Unit Test Effectiveness

Name: Unit Test Effectiveness
Process/Sub-process: Testing / Testing Execution
Goal: Improve unit test effectiveness.
Information Needs: What is the unit test effectiveness?
Measures: Density of Detected Defect in the Unit Test, Number of Detected Defects in the Unit Test, Product Size, Density of Delivered Defects in the Unit Test, Number of Delivered Defects in the Unit Test.
Operational Definition of Measures:

Derived Measure	Density of Detected Defect in Unit Test
Mnemonic	DDDUT
Description	Measure used to quantify the density of defects detected during the unit test, which is given by the ratio between the number of detected defects in the unit test and the size of the tested product.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects/*<<KSLOC or FP>>*
Formula	DDDUT = (NDDUT /PS)
Measurement Procedure	Calculate the density of defects detected during the unit test using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each execution of the unit test.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	At the end of the unit test.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Number of Detected Defects in the Unit Test
Mnemonic	NDDUT
Description	Measure which quantifies the number of defects detected in the unit test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of defects detected in the unit test.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers.
Measurement Unit	*<<KSLOC or FP>>*
Formula	-
Measurement Procedure	Obtain the *<<number of source-code lines or function points>>* of the product to be considered.

Measure	Densitiy of Delivered Defects in the Unit Test
Mnemonic	DDelDUT
Description	Measure used to quantify the density of defects delivered in the unit test, which is given by the ratio between the number of defects delivered in the unit test and the size of the delivered product. Delivered defects refer to defects delivered to the client and that should have been detected during test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficacy

Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects /<<*KSLOC or FP*>>
Formula	DDelDUT = (NDelDUT /PS)
Measurement Procedure	Calculate the density of delivered defects in the unit test using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	<<*A frequency for data collection can be established (for example, weekly or biweekly) and the measurement should be performed considering the product delivered in the referred period. Alternatively, data collection can be performed referring to a certain portion of the delivered product (e.g., a unit or module).* >>
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	<<*Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.*>>
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measure 1	Number of Delivered Defects in the Unit Test
Mnemonic	NDelDUT
Description	Measure which quantifies the number of defects delivered in the unit test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficacy
Scale	Positive real Numbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of delivered defects in the unit test. Here, the delivered defects refer to defects reported by the client and that should have been detected during unit test.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers.
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points* >> of the product to be considered.

Related Patterns: Test Effectiveness.

System Test Effectiveness

Name: System Test Effectiveness
Process/Sub-process: Testing / Testing Execution
Goal: Improve systems test effectiveness.
Information Needs: What is the system test effectiveness?
Measures: Density of Detected Defects in the System Test, Number of Detected Defects in the System Test, Product Size, Density of Delivered Defect of in the System Test, Number of Delivered Defect in the System Test.
Operational Definition of Measures:

Derived Measure	Density of Detected Defects in the System Test
Mnemonic	DDDST
Description	Measure used to quantify the density of defects detected during the system test, which is given by the ratio between the number of detected defects in the system test and the size of the tested product.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects/<<*KSLOC or FP*>>
Formula	DDDST = (NDDST/PS)
Measurement Procedure	Calculate the density of defects detected during the system test using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each execution of the system test.
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	At the end of the system test.
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measure 1	Number of Detected Defects in the System Test
Mnemonic	NDDST
Description	Measure which quantifies the number of defects detected in the system test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects in the system test.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points*>> of the product to be considered.

Measure	Density of Delivered Defects in the System Test
Mnemonic	DDelDST
Description	Measure used to quantify the density of defects delivered in the system test, which is given by the ratio between the number of defects delivered in the system test and the size of the delivered product. Delivered defects refer to defects delivered to the client and that should have been detected during test.
Measurable Entity	Testing Execution Sub-process

Measurable Property	Efficacy
Scale	Positive real numbers accurate to two decimal places.
Measurement Unit	Defects /<<*KSLOC or FP*>>
Formula	DDelDST = (NDelDST/PS)
Measurement Procedure	Calculate the density of delivered defects in the system test using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	<<*A frequency for data collection can be established (for example, weekly or biweekly) and the measurement should be performed considering the product delivered in the referred period. Alternatively, data collection can be performed referring to a certain portion of the delivered product (e.g., a unit or module).* >>
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	<<*Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.*>>
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measure 1	Number of Delivered Defects in the System Test
Mnemonic	NDelDST
Description	Measure which quantifies the number of delivered defects in the system test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficacy
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of delivered defects in the system test. Here, the delivered defects refer to defects reported by the client and that should have been detected during system test.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points*>> of the product to be considered.

Related Patterns: Test Effectiveness.

Integration Test Effectiveness

Name: Integration Test Effectiveness
Process/Sub-process: Testing / Testing Execution
Goal: Improve integration test effectiveness.
Information Needs: What is the integration test effectiveness?
Measures: Density of Detected Defects in the Integration Test, Number of Detected Defects in the Integration Test, Product Size, Density of Delivered Defects in the Integration Test, Number of Delivered Defects in the Integration Test.
Operational Definition of Measures:

Derived Measure	Density of Detected Defects in the Integration Test
Mnemonic	DDDIT
Description	Measure used to quantify the density of defects detected during the integration test, which is given by the ratio between the number of detected defects in the integration test and the size of the tested product.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects/<<*KSLOC or FP*>>
Formula	DDDIT = (NDDIT /PS)
Measurement Procedure	Calculate the detected defects density detected in the integration test using the formula for calculating the measure.
Measurement Periodicity	The measurement should be made in each execution of the integration test.
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	At the end of the integration test.
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measure 1	Number of Detected Defects in the Integration Test
Mnemonic	NDDIT
Description	Measure which quantifies the number of detected defects in the integration test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Detected Defects
Scale	Positive real numbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects in the integration test.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers.
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points*>> of the product to be considered.

Measure	Density of Delivered Defects in the Integration Test
Mnemonic	DDelDIT
Description	Measure used to quantify the density of defects delivered in the integration test, which is given by the ratio between the number of defects delivered in the integration test and the size of the delivered product. Delivered defects refer to defects delivered to the client and that should have been detected during test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficacy
Scale	Positive real numbers, accurate to two decimal places.

Measurement Unit	Defects /<<*KSLOC or FP*>>
Formula	DDelDIT = (NDelDIT/PS)
Measurement Procedure	Calculate the density of delivered defects in the integration test using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	<<*A frequency for data collection can be established (for example, weekly or biweekly) and the measurement should be performed considering the product delivered in the referred period. Alternatively, data collection can be performed referring to a certain portion of the delivered product (e.g., a unit or module).* >>
Measurement Responsible	<<*Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider* >>
Measurement Moment	<<*Indicate the moment at which data collection and recording should be performed. The moment of collection should be an activity of the project process or of an organizational process.*>>
Measurement Analysis Procedure	<<*Standard measurement analysis procedure for SPC in the context of processes maturity models.*>>
Analysis Periodicity	<<*Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.*>>
Analysis Responsible	<<*Indicate the role responsible for analyzing data collected for the measure*>>
Analysis Moment	<<*Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).*>>
Base Measurement 1	Number of Delivered Defects in the Integration Test
Mnemonic	NDelDIT
Description	Measure which quantifies the number of missed defects in the integration test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficacy
Scale	Positive real numbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of delivered defects in the integration test. Here, the delivered defects refer to defects reported by the client and that should have been detected during integration test.
Base Measurement 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers.
Measurement Unit	<<*KSLOC or FP*>>
Formula	-
Measurement Procedure	Obtain the <<*number of source-code lines or function points*>> of the product to be considered.

Related Patterns: Test Effectiveness.

Test Efficiency

Name: Test Efficiency
Process/Sub-process: Testing / Testing Execution
Goal: Improve test efficiency.
Information Needs: What is the test efficiency?
Measures: Test Efficiency, Number of Detected Defects, Test Effort.
Operational Definition of Measures:

Derived Measure	Test Efficiency
Mnemonic	TE
Description	Measure used to quantify the test efficiency, which is given by the ratio between the effort spent on detecting defects and the number of defects detected in the test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficiency
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	man-hour/defect
Formula	TE = (TEf/NDD)
Measurement Procedure	Calculate the test efficientcy using the formula for calculating the measure, considering the same test execution for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each test execution.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider>>*
Measurement Moment	At the end of the test execution.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Test Effort
Mnemonic	TEf
Description	Measure which quantifies the effort spent on the test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Effort
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the effort spent to perform the test.
Base Measure 2	Number of Detected Defects
Mnemonic	NDD
Description	Measure which quantifies the number of defects detected in the test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects in the test.

Related Patterns: Test Effectiveness, Unit Test Efficiency, System Test Efficiency, Integration Test Efficiency.

Unit Test Efficiency

Name: Unit Test Efficiency
Process/Sub-process: Testing / Testing Execution
Goal: Improve unit test efficiency.
Information Needs: What is the unit test efficiency?
Measures: Unit Test Efficiency, Number of Detected Defects in the Unit Test, Unit Test Effort.
Operational Definition of Measures:

Derived Measure	Unit Test Efficiency
Mnemonic	UTE
Description	Measure used to quantify the unit test efficiency, which is given by the ratio between the effort in the unit test and the number of defects detected in the unit test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficiency
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	man-hour/defect
Formula	UTE = (UTEf/NDDUT)
Measurement Procedure	Calculate the unit test efficiency using the formula for calculating the measure, considering the same unit test execution for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each the unit test execution.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider>>*
Measurement Moment	At the end of the unit test execution.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Unit Test Effort
Mnemonic	UTEf
Description	Measure which quantifies the effort spent on the unit test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Effort
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the effort spent to perform the unit test.
Base Measure 2	Number of Detected Defects in the Unit Test
Mnemonic	NDDUT
Description	Measure which quantifies the number of defects detected in the unit test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real rumbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects in the unit test.

Related Patterns: Test Efficiency.

System Test Efficiency

Name: System Test Efficiency
Process/Sub-process: Testing / Testing Execution
Goal: Improve system test efficiency.
Information Needs: What is the system test efficiency?
Measure: System Test Efficiency, Number of Detected Defects in the System Test, System Test Effort.
Operational Definition of Measures:

Derived Measure	System Test Efficiency
Mnemonic	STE
Description	Measure used to quantify the system test efficiency, which is given by the ratio between the effort in the system test and the number of defects detected in the system test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficiency
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects /man-hour
Formula	STE = (STEf / NDDST)
Measurement Procedure	Calculate the system test efficiency using the formula for calculating the measure, considering the same system test execution for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each the system test execution.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider>>*
Measurement Moment	At the end of the system test execution.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 2	System Test Effort
Mnemonic	STEf
Description	Measure which quantifies the effort spent in the detection of defects in the system test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Effort
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the effort spent to perform system test.
Base Measure 1	Number of Detected Defects in the System Test
Mnemonic	NDDST
Description	Measure which quantifies the number of detected defects in the system test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real rumbers.
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects in the system test.

Related Patterns: Test Efficiency.

Integration Test Efficiency

Name: Integration Test Efficiency
Process/Sub-process: Testing / Testing Execution
Goal: Improve integration Test efficiency.
Information Needs: What is the integration test efficiency?
Measures: Integration Test Efficiency, Number of Detected Defects in the Integration Test, Integration Test Effort.
Operational Definition of Measures:

Derived Measure	Integration Test Efficiency
Mnemonic	ITE
Description	Measure used to quantify the integration test efficiency, which is given by the ratio between the effort in the integration test and the number of defects detected in the integration test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Efficiency
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects /man-hour
Formula	ITE = (ITEf / NDDIT)
Measurement Procedure	Calculate the integration test efficiency using the formula for calculating the measure, considering the same integration test execution for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each the integration test execution.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	At the end of the integration test execution.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Integration Test Effort
Mnemonic	ITEf
Description	Measure which quantifies the effort spent in the detection of defects in the integration test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Effort
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the effort spent to perform integration test.
Base Measure 2	Number of Detected Defects in the Integration Test
Mnemonic	NDDIT
Description	Measure which quantifies the number of detected defects in the integration test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of detected defects in the integration test.

Related Patterns: Test Efficiency.

Test Preparation Productivity

Name: Test Preparation Productivity
Process/Sub-process: Testing / Testing Execution
Goal: Improve productivity in test preparation.
Information Needs: What is the productivity in test preparation?
Measures: Test Preparation Productivity, Test Preparation Effort, Number of Elaborated Test Cases.
Operational Definition of Measures:

Derived Measure	Test Preparation Productivity
Mnemonic	TPP
Description	Measure used to quantify the test preparation productivity, which is given by the ration between the effort spent to prepare the test and the number of elaborated test cases.
Measurable Entity	Testing Preparation Sub-process
Measurable Property	Productivity
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	man-hour/test case
Formula	TPP = (TPEf/NETC)
Measurement Procedure	Calculate the test preparation productivity using the formula for calculating the measure, considering the same test preparation for both base measures of the formula.
Measurement Periodicity	The measuring should be carried out at each test preparation.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	At the end of the test preparation.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Test Preparation Effort
Mnemonic	TPEf
Description	Measure which quantifies the effort spent on the preparation of the test.
Measurable Entity	Testing Preparation Sub-process
Measurable Property	Effort
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the effort spent on the test preparation.
Base Measure 2	Number of Elaborated Test Cases
Mnemonic	NETC
Description	Measure which quantifies the number of test cases elaborated in the preparation of the test.
Measurable Entity	Testing Preparation Sub-process
Measurable Property	Performance
Scale	Positive real numbers
Measurement Unit	-
Formula	-
Measurement Procedure	Obtain the number of test cases elaborated in the preparation of the test.

Related Patterns: Test Preparation Efficiency.

Test Preparation Efficiency

Name: Test Preparation Efficiency
Process/Sub-process: Testing / Testing Execution
Goal: Improve efficiency in test preparation.
Information Needs: What is the test preparation efficiency?
Measures: Test Preparation Efficiency, Detected Defects Density, Number of Detected Defects, Product Size, Test Preparation Effort.
Operational Definition of Measures:

Derived Measure 1	Test Preparation Efficiency
Mnemonic	TPE
Description	Measure used to quantify the test preparation efficiency, which is given by the ratio between the detected defects density and the effort spent on the test preparation.
Measurable Entity	Testing Preparation Sub-process
Measurable Property	Efficiency
Scale	Positive real numbers accurate to two decimal places
Measurement Unit	(Defects/*<<KSLOC or FP>>*)/ Man-Hour
Formula	TPE = (DDD/TPEf)
Measurement Procedure	Calculate efficiency of test preparation using the formula for calculating the measure. The test execution considered in DDD must be the execution of the test preparation considered in TPE.
Measurement Periodicity	The measurement should be carried out at each test execution.
Measurement Responsible	*<<Indicate the role responsible for collecting data for the measure. It is recommended that the measurement responsible is the data provider >>*
Measurement Moment	At the end of each test execution.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Derived Measure 2	Detected Defects Density
Mnemonic	DDD
Description	Measure used to quantify the detected defects density, which is given by the ratio between the number of detected defects and the size of the tested product.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers, accurate to two decimal places.
Measurement Unit	Defects /*<<KSLOC or FP>>*
Formula	DDD = (NDD /PS)
Measurement Procedure	Calculate the density of detected defects using the formula for calculating the measure, considering the same product (or portion of product) for both base measures of the formula.
Measurement Periodicity	The measurement should be carried out at each test execution.
Measurement Analysis Procedure	*<<Standard measurement analysis procedure for SPC in the context of processes maturity models.>>*
Analysis Periodicity	*<<Indicate the periodicity based on a time period (e.g., fortnightly) or on an amount of new data collected (e.g., each 4 new values collected). Different periodicities can be established to analyze data in the project and in the organizational contexts.>>*
Analysis Responsible	*<<Indicate the role responsible for analyzing data collected for the measure>>*
Analysis Moment	*<<Indicate the moment at which data analysis should be performed. The moment of analysis should be an activity of the project process (to analyze data in the project context) or of an organizational process (to analyze data in the organizational context).>>*
Base Measure 1	Number of Detected Defects
Mnemonic	NDD
Description	Measure which quantifies the number of detected defects in the test.
Measurable Entity	Testing Execution Sub-process
Measurable Property	Performance
Scale	Positive real numbers
Measurement Unit	-
Formula	-

Measurement Procedure	Obtain the number of detected defects in the test.
Base Measure 2	Product Size
Mnemonic	PS
Description	Measure which quantifies the size of the product to be considered.
Measurable Entity	Software
Measurable Property	Size
Scale	Positive real numbers.
Measurement Unit	*<<KSLOC or FP>>*
Formula	-
Measurement Procedure	Obtain the *<<number of source-code lines or function points >>* of the product to be considered.
Base Measure 3	Test Preparation Effort
Mnemonic	TPEf
Description	Measure which quantifies the effort in the preparation of the test.
Measurable Entity	Testing Preparation Sub-process
Measurable Property	Effort
Scale	Positive real numbers accurate to two decimal places.
Measurement Unit	Man-hour
Formula	-
Measurement Procedure	Obtain the effort spent in the test preparation.

Related Patterns: Test Preparation Productivity.

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