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| GENUS innovation limited |
| Measurement and Analysis Procedure |
| PRCD\_MEASUR.docx |
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| **Genus** |

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| The purpose of Measurement and Analysis (MA) is to provide objective data on the actual progress of a project and communicate project and product status to support management’s ability to understand it. Measurement and Analysis also gives an objective insight into the Process’ Performance and demonstrates the Organisation’s trends. |

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# Overview

The purpose of Measurement and Analysis (MA) is to provide objective data on the actual progress of a project and communicate project and product status to support management’s ability to understand it. Measurement and Analysis also gives an objective insight into the Process’ Performance and demonstrates the Organisation’s trends.

# Objective

To give a quantitative insight to the organization’s objective in exceeding customer satisfaction in terms of Quality, Cost & On-time Delivery and providing a nurturing environment to the employees to flourish and grow.

The business objectives of Genus are:

1. Improve Quality of the Product
2. Optimization of Project Costs
3. Improve on-Time Delivery Performance
4. Provide nurturing environment to our employees to flourish and grow

# Scope

This procedure applies to all the development projects.

# Inputs

* Review and Testing Defect Log
* Effort Estimates from Requirement Traceability Table
* Actual efforts expended from the Timesheets
* Schedule Estimates of each milestone in the Project Plan
* Audit Non-conformance log.
* Business Objectives to Process Objectives Mapping Document
* Training Records

# Entry Criteria/Triggers

* Plan Approval
* Periodicity defined in Business Objectives to Process Objectives Mapping
* The practitioners have undergone QMS trainings with focus on performing their processes.

# Tasks

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Task** | **Owner/Role** |
|  | **Prepare Measurement Plan** |  |
|  | Plan for measurement activities. Refer “Business Objectives to Process Objectives Mapping” document (MSTL\_BOTOPO), to identify measures in the project. | Project Manager |
|  | Specify Project specific targets, if any. | Project Manager |
|  | Specify selected measures in the “Measurement and Analysis Plan” section, in the Project Plan. | Project Manager |
|  | Identify and specify the required tools. Consider “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE). | Project Manager |
|  | Review and approve the “Measurement Plan”. | Senior Management |
|  | **Measurement Definition, Data Collection and Data Analysis**. |  |
|  | **Project Level Measurements** |  |
|  | ***Measurement***  **Product Defect Density**  The purpose of this measurement is to reduce the number of defects in the product delivered to the customer.  ***Definition***  Product Defect Density is the number of functional defects detected in Review, Testing and Validation in the project’s lifecycle divided by the size of the project defined as proportional to the actual person hours expended in the project.  ***Input***   * Consolidate all Functional Defects from “Review & Testing Defect Log” for the Project. * Consolidate the total number of person hours from the “Timesheet” for the project. * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base Measures***   * # of defects detected in Review, Testing and Validation * Total Person hours expanded in the project   ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Project Level***  Calculate  (Functional Defects detected in Review, Testing and Validation for the specified project) /(Total number of person hours for the project)  The Product Defect Density calculated above should be within the defined measurement goal in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO).  This measurement can only be carried out at project closure. | Project Manager |
|  | ***Measurement***  **Project’s Process Defect Density**  The purpose of this measurement is to reduce the number of process defects in the project.  ***Definition***  Project’s Process Defect Density is the number of Non-conformances divided by the size of the product defined as proportional to the actual person hours expended in the project.  ***Input***   * Consolidate all Non-conformances from “Audit Non Conformance Log” for the Project. * Consolidate the total number of person hours from the “Timesheet” for the project. * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base Measures***   * # of major NCs in the project * # of minor NCs in the project * Total Person hours expanded in the project   ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Project Level***  Calculate  (5 x Number of Major NCs in the project + 1 x Number of Minor NCs) /(Total number of person hours for the project)  The Project’s Process Defect Density calculated above should be within the defined measurement goal in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO).  This measurement can only be carried out at project closure. | Project Manager |
|  | ***Measurement***  **Schedule Variance**  The purpose of this measurement is to reduce Schedule Variance from the Project’s Planned Schedules for each milestone.  ***Definition***  Schedule Variance measures the difference between scheduled and achieved milestone durations for a project.  ***Input***   * “Schedules by Milestone” Log * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base Measures***   * Planned milestone dates * Actual Milestone Dates   ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Project Level***   * Calculate Planned Duration between Milestones and Actual Duration between Milestones. * Calculate   100 x ((Actual Duration for milestone- Planned Duration for milestone)/Planned Duration for Milestone)  for each milestone of the project.  The Schedule Variance calculated above should be less than the defined measurement goal in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO).   * Plot the Schedule Variance against each milestone with the milestones on X axis. * Plot the Upper Specification Limit and Lower Specification Limit as defined in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO).   This measurement is carried out at each milestone. At project closure, overall deviation from the schedule shall also be calculated. | Project Manager |
|  | ***Measurement***  **Effort Variance**  The purpose of this measurement is to reduce Effort Variance from the Project’s Planned Efforts in order to optimize the Cost of Project execution.  ***Definition***  Effort Variance measures the difference between Planned and Actual efforts expended for a Project from the Project’s Start.  ***Input***   * Planned Efforts in “Schedules by Milestone” Log * Timesheets * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base measures***  Efforts logged in Timesheet  ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Project Level***   * Calculate Planned Efforts between Milestones and Actual Efforts between Milestones for the project. * Calculate   100 x ((Actual Efforts for milestone- Planned Efforts for milestone)/Planned Effort for Milestone)  For each milestone.  The Effort Variance calculated above should be less than the defined measurement goal in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO).   * Plot the Effort Variance against each milestone with the milestones on X axis. * Plot the Upper Specification Limit and Lower Specification Limit as defined in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO).   This measurement is carried out at each milestone. At project closure, overall deviation from the schedule shall also be calculated.  The effort variance for the Requirements development phase, calculated at the end of the requirements development phase—before the planning phase— will use the preliminary effort estimates arrived at the start of the project.  The Metrics reports generated after the planning phase will use the effort estimates derived using the lifecycle estimates, in addition to the variances generated using the preliminary estimates for the RD phase. | Project Manager |
|  | ***Measurement***  **For any other identified measurements**  The purpose of this measurement is to quantitatively analyze and monitor a parameter that is considered critical for a specific project/ process.  ***Collect Data***   * Collect the data by suitable means, as defined in the project’s measurement plan.   ***Analyze Data***   * Consolidate the collected data. * Analyze the data by suitable means. * Plot a suitable graph to accurately represent the data. | Project Manager |
|  | **Project Metrics Report** |  |
|  | Prepare the Project Metrics Report on carrying out each measurement as defined above. The Metrics report is updated at each phase end. Use “Project Metrics Report Template” (TMPL\_MESRPT). | Project Manager |
|  | Get the metrics report reviewed by the PPQA member. | Project Manager |
|  | Review the report with respect to the data gathered and the conclusions arrived at. | PPQA Member |
|  | Take suitable corrective and preventive measures based on the metrics report for the project. | Project Manager |
|  | Send the Metrics report to the PEG and relevant stakeholders at the end of each milestone. | Project Manager |
|  | **Organization Level Measurements** |  |
|  | ***Measurement***  **Product Defect Density**  The purpose of this measurement is to reduce the number of defects in the product delivered to the customer.  ***Definition***  Product Defect Density is the number of functional defects detected in Review, Testing and Validation in the project’s Lifecycle divided by the size of the product defined as proportional to the actual person hours expended in the project.  ***Input***   * Consolidate all Functional Defects from “Review & Testing Defect Log” for the Project. * Consolidate the total number of person hours from the “Timesheet” for the project. * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base Measures***   * # of defects detected in Review, Testing and Validation * Total Person hours expanded in the project   ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Organizational Level***  Calculate  (Functional Defects detected in Review, Testing and Validation for the specified project) /(Total number of person hours for the project)  The Product Defect Density calculated above should be within the defined measurement goal in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO). | PEG |
|  | ***Measurement***  **Project’s Process Defect Density**  The purpose of this measurement is to reduce the number of process defects in the project.  ***Definition***  Project’s Process Defect Density is the number of Non-conformances divided by the size of the product defined as proportional to the actual person hours expended in the project.  ***Input***   * Consolidate all Non-conformances from “Audit Non Conformance Log” for the Project. * Consolidate the total number of person hours from the “Timesheet” for the project. * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base Measures***   * # of NCs in the project * Total Person hours expanded in the project   ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Organizational Level***  Calculate   * (5 x Number of Major NCs in the project + 1 x Number of Minor NCs) / (Total number of person hours for the project) The Project’s Process Defect Density calculated above should be within the defined measurement goal in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO). | PEG |
|  | ***Measurement***  **Schedule Variance**  The purpose of this measurement is to reduce Schedule Variance from the Project’s Planned duration (Project Start to Project Closure). This takes only closed project in consideration.  ***Definition***  Schedule Variance measures the difference between scheduled and achieved duration for a project.  ***Input***   * “Schedules by Milestone” Log * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base Measures***   * Planned Project Duration * Actual Project Duration   ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Organizational Level***   * Collect the Schedule Variance of all the Projects executed during the measurement period. The Schedule Variance of a project is   100 x ((Actual Project Duration - Planned Project Duration)/ Planned Project Duration)   * Plot the Schedule Variance against each project with the Project codes on X axis. * Plot the Upper Specification Limit and Lower Specification Limit as defined in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO). | PEG |
|  | ***Measurement***  **Effort Variance**  The purpose of this measurement is to reduce Effort Variance from the Project’s Planned Efforts in order to optimize the Cost of Project execution. This takes only closed project in consideration.  ***Definition***  Effort Variance measures the difference between Planned and Actual efforts expended for a Project from the Project’s Start.  ***Input***   * Planned Efforts in “Schedules by Milestone” Log * Timesheets * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base measures***  Efforts logged in Timesheets  ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Organizational Level***   * Collect the Effort Variance of all the projects executed during the measurement period. The Effort variance of a project is   100 x ((Actual Project Efforts - Planned Project Efforts)/ Planned Project Efforts)   * Plot the Efforts Variance against each project with the Project Codes on X axis. * Plot the Upper Specification Limit and Lower Specification Limit as defined in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO). | PEG |
|  | ***Measurement***  **Training Effectiveness**  The purpose of this measurement is to gauge the effectiveness of trainings delivered in the month. This takes only closed project in consideration.  ***Definition***  Training Effectiveness is the average of Training Feedback ratings in a month out of a possible rating of 10.  ***Input***   * Training Records * Ensure that the data quality checks built into the “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE) pass.   ***Base Measures***  Training ratings data  ***Tools***  “Data Collection, Measurement, Analysis and Reporting Tool” (TOOL\_MESURE)  ***Data Analysis at Organizational Level***  Calculate  Average of Training Feedback Ratings in the specified month  The Training Effectiveness calculated above should be more than the defined measurement goal in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO)   * Plot the month’s Training Effectiveness against the Month on the X axis. * Plot the Upper Specification Limit and Lower Specification Limit as defined in “Business Objective to Process Objective Mapping” document (MSTL\_BOTOPO). | PEG |
|  | **Metrics Baseline Report** |  |
|  | The Metrics Baseline Report is prepared every Quarter or when sufficient number of closed projects is available. Consolidate all organizational level measurements. Place the Metrics report in the organization’s measurement repository. Archive the base measures used to derive the Metrics baseline report in the measurement repository. | PEG |
|  | Derive the measurements’ statistical conclusions. | PEG |
|  | Arrive at possible corrective and preventive actions. | PEG |
|  | Revise the goals if necessary. | PEG |
|  | Report these measurements to the Senior Management. | PEG |

\* Improvements/Suggestions are solicited on “Process Improvement Proposals Database”.  
\*For details on the Roles and Responsibilities of the practitioners, Refer "Roles and Responsibility" document in the QMS.

# Verification

* Review of Measurement Plan by PPQA Member
* Review of Organizational Level Measurement and Analysis Data by PEG
* Review of Project Level Measurement and Analysis Data by PPQA Group Member
* Review of the process and its work products by PPQA members.
* Review of the process and its work products by Senior Management.

# Guidelines

Refer "Configuration Management and Release Procedure" (PRCD\_CONFIG) for Access Rights, location of work products, naming convention and types of controls.

## Calculation of Cpk

Cpk takes into account the center of the data relative to the specifications, as well as the variation in the process. Cpk is simple to calculate. The smaller of the two Z values is selected. This is known as Zmin. When Zmin has been selected, it is divided by 3. The formula is:

http://www.qualityadvisor.com/library/images/cpk.gif

Where Z = or

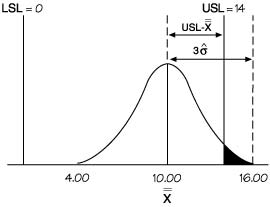
If the Cpk formula is written in full, it becomes more apparent how Cpk works.

http://www.qualityadvisor.com/library/images/cpk.gif

This is the smaller of:

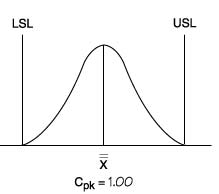
http://www.qualityadvisor.com/library/images/cpk-full.gif

Graphically this can be drawn for the example as follows:



The diagram clearly shows that the overall average is too close to the upper specification. By taking the smaller of the two Z values, Cpk is always looking at the worst side, where the specification is closest to the overall average. Since it is looking only at half the picture, instead of dividing by 6http://www.qualityadvisor.com/library/images/sigma-hat-sm.gif as in Cp, it is divided by 3http://www.qualityadvisor.com/library/images/sigma-hat-sm.gif.

A Cpk value of one indicates that the tail of the distribution and the specification are an equal distance from the overall average, as shown below:



A Cpk of less than one, as in the example, means that some of the data is beyond the specification limit. A Cpk greater than one indicates that the data is within the specification. The larger the Cpk, the more central and within specification the data.

# Applicable Measurements

NA

# Exit Criteria/Outputs

* Measurement Data Reports
* Approved Measurement and Analysis Plan
* Revised Organizational Goals