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Defect Prevention

Abstract:

In recent years the emphasis on software quality has increased due to forces from several sectors of the computer industry. Defect Prevention is one of the most important activities of a software development life cycle, which has a direct impact on controlling the cost of the project and the quality of the deliverables.

Defect prevention involves
1) Logging the defects encountered.
2) Analyzing the defects to find the reason that caused this defect to occur
3) Ensure that these defects do not recur by suggesting preventive techniques.

The cost of rectifying defect in the product is very much higher compared to preventing it in the first place. As the delay in detecting the defect increases, the cost of the fixing the defect increases exponentially. Hence it is always advisable to take measures, which will prevent the defect being introduced in the product, as early as possible. The cost of these measures is minimal compared to cost of fixing the defect at later stage.

Syntel is assessed at Level 5 of the Process maturity on the SEI Software CMM.

All practices defined in Level 5 of the CMM Model are being implemented in every project. The purpose of this paper is to underline the importance of Defect Prevention and to walk through the various DP activities carried out at Syntel India Ltd. Topics discussed in this paper are:

❖ Syntel's Policy for defect prevention activities

❖ Defect prevention data logging

❖ Defects Measurement and Analysis

❖ Defect Prevention techniques

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Organization Policy for defect prevention activities

As per the Organization policy,
- At the organization level the DP (Defect Prevention) Board manages defects prevention activities.
- At the project level the DP Coordinator appointed by the Project Manager manages the prevention activities.
- The DP Board establishes a long-term plan for defect prevention activities.
- Results of DP activities are reviewed by senior management to monitor their effectiveness

In keeping with the Organization Policy, Syntel has a DP board, which has representation from SEPG (Software Engineering Process Group).

The DP board has a Quarterly plan in which it sets Organization level goals, the various activities to be carried out to achieve these goals. It also decides as to what reports needs to be generated and what Metrics needs to be monitored.

Based on QM (Quantitative Management) board inputs, the DP board targets specific areas where it needs to concentrate its DP activities on. The current goal of the DP board set in September 2001 is 5% reduction in defect density over a period of 3 months.

Defect prevention data logging

At the Project level, a DP coordinator is appointed by the Project Manager to coordinate the DP activities across the Project. The DP-Coordinator is trained by the DP Board and the SEPG group to carry out DP activities.

Syntel adopts Peer review process and accordingly Peers review all deliverables. The defects encountered in the review process are logged onto the Defect Register (Appendix A).
The defects logged are classified by
1) Phase in which they occurred (Requirements, Design, Coding, Testing etc).
2) The severity (A, B, C, D). Each severity is assigned a weight (A=8,B=4,C=2,D=1).
3) The type of defect. The defects are classified as per the Orthogonal Defect Classification by IBM into 8 different types, Viz. F-Function, A-Assignment, I-Interface, C-Checking, B-Build, D-Documentation, G-Algorithm, T-Timing.
4) The Detecting agency (Internal if during Peer review, External if by an agency external to the Project and Customer if by the Client/customer)

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Defects Measurement and Analysis

At the end of every month, data from defect register is consolidated and a causal analysis report is prepared. All the DP Coordinators carry out this activity across their respective projects.
A sample of the Causal Analysis report is attached in Appendix B.

Due to some cause (error) the defects get incorporated in the program. After Analyzing the root cause of the defect, the preventive action for the defect can be provided. This will reduce the number of defects occurring henceforth.

During Causal Analysis weighted defects for each defect type are listed down. The DP coordinator then decides which types of defects need to be analyzed for a root cause. This need not be the defect type, which have the maximum number of defects. After targeting the type of defects, a detailed root cause analysis is carried out and the causes of the defects are detected. Subsequent to this preventive action is proposed to prevent the recurrence of these types of defects. Fish Bone / Ishikawa diagrams are also used for complex Root cause analysis.

Causal analysis is done regularly by the DP Coordinator (using Pareto Chart) once a month, which are reviewed by, DM (Delivery Manager) and SQA (Software Quality Assurance). Results of preventive /corrective actions are reviewed in the next months Causal Analysis and benefits are noted down.

Besides conveying the Preventive measures to the Project team, the DP coordinator also sends the Causal Analysis report to the DP Board, and this is discussed during the boards monthly meeting. The DP board then passes on the preventive actions to all other projects. If these actions involve any changes to the Organizations Standard Software Process, they are conveyed to the Process Change Management Board through formal "Process Improvement Proposals".

The DP Board consolidates the data collected from all the projects and circulates the preventive actions suggested during the monthly board meeting to all projects.

The DP Board also performs a Quarterly Cost Benefit analysis and reports the findings to the COO (Chief Operating Officer). This analysis includes:
1) Highlights for the period
2) Effort expended in person hours
3) Tangible results actually obtained, in quantitative terms like
   a) Percentage reduction in effort
   b) Percentage reduction in number of defects.
4) Intangible benefit obtained e. g. customer feedback, employee feedback etc.
5) Tangible results projected for the next twelve months in quantitative terms

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Defect Prevention techniques

The DP coordinator holds a monthly team meeting in which he presents the findings of the Causal Analysis report. The causes of the defects are discussed and preventive methods are shared between the team members. Action items are decided and responsibilities are fixed for carrying out these actions.

At the beginning of every phase of a project, or at the project initiation meeting, the DP coordinator is responsible for propagating the preventive actions proposed in the project as of that date to the entire project team.

The DP Board meets on monthly basis to review and analyze the causal analysis reports received from the projects. All Action Proposals submitted by projects and preventive measures, proposed (or followed) by projects are analyzed by the DP board. This analysis is available to everybody at organization level. The projects can share the information and learn from and prevent the mistakes that occurred in other projects.

Projects in the organization implement some or all action proposal suggested by DP Board. DP Board may also propose some of the action proposals on a pilot basis.
This monthly status report (Organization wide, defect causal analysis report) includes:
- A summary of the major defect types reported during the month
- Major achievements and successful implementation of action in defect prevention
- Status of the incomplete action proposals

Benefits Observed:

1) Checklists developed for review have improved a lot.
2) Rework effort has reduced.
3) Number of weighted defects/program has reduced.
4) Training program has improved.
5) Projects are now operating with lesser defects even with a lesser percentage of experienced resources.

Conclusion

Defect prevention activity involves

1) Understand the mechanisms for defect detection and prevention.
2) Know how to collect, categorize and use defect information.
3) Find where to apply lessons learned.
4) Root cause analysis
5) Apply the defect prevention process.

Applying these guidelines Syntel has successfully achieved the goal set by the Defect Prevention Board in the Defect prevention plan for the June 2001.

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Appendix A

Defect Register

Defect Register

Project Id:	Project Name	
Module / System ID:	Module/System Name:	

Task No.	Defect Detection Activity	Defect Number	Defect Description	Detection Phase	Agency	Occurrence Phase	Severity Level	Defect Type

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Project Id   Module Id   :
Project Name   Module Name :
Month & Year

Detection - Phase / Occurrence Phase	RDD Review				Specs Review				Code Review				Unit Test Plan Review				Unit Test Results Review				System Test Plan Review				System Test Results Review				Documentation Review				UAT Plan Review				UAT Results Review				Post Implementation				Sub Total				TOTAL
Severity Level	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
Requirement Analysis																																													
System Design																																													
Coding																																													
Unit Test Planning																																													
Unit Testing																																													
System Test Planning																																													
System Testing																																													
Documentation																																													
UAT Planning																																													
UAT																																													
Implementation																																													
Sub Total																																													
TOTAL																																													

Severity Level

A. Program not operable   Project Manager/Leader:

B. Major / Important function not operable

C. Minor function not operable   Date   :
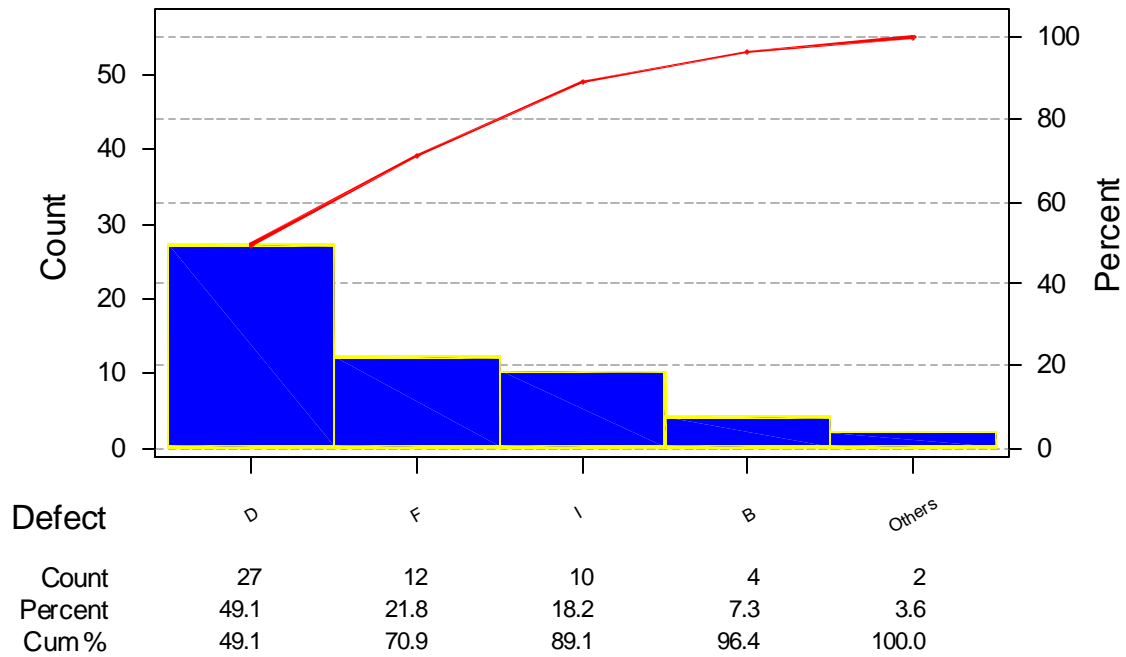
D. Cosmetic errors

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Appendix B

Sample Causal Analysis Report:

Causal Analysis Report for the Period from 07/01/01 to 07/31/01

Project ID : **99**	Project Name : **Project 1**

Defect Type-wise data sheet

S.L\D.T	A	B	C	D	F	G	I	T	TOTAL WTD. DEFECTS
A	0	0	0	2	0	0	0	0	-
B	0	1	0	0	3	0	0	0	-
C	0	0	1	5	0	0	4	0	-
D	0	0	0	1	0	0	2	0	-
Wtd. Defects	0	4	2	27	12	0	10	0	55
Percentage(%)	0.0	7.0	3.0	49.0	21.0	0.0	18.0	0.0	100.0

Defect Type	Desc
F	Function
A	Assignment
I	Interface
C	Checking
B	Build
D	Documentation
L	Algorithm
T	Timing

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Defect Type-Wise Pareto Diagram

PROJECT 1 - JULY 2001

Defect	D	F	\	B	Others
Count	27	12	10	4	2
Percent	49.1	21.8	18.2	7.3	3.6
Cum %	49.1	70.9	89.1	96.4	100.0

Analysis:

Type D defects are maximum for this month.
We will be analyzing these defects for the root cause.

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Analysis Report :

<u>Causes for Defect Type 'D'</u>

No	Defects	Causes
1	Back Page message paragraph not proper.	Lapse on part of programmer in following the Project standards.
2	In para 'CJAAA-SUB-…' sub cat record not proper.	Lapse on part of programmer in following the Project standards.
3	Indentation not proper	Lapse on part of programmer in following the Project standards.
4	Message counter is not properly applied	Unclear Specifications
5	Comment box is not as per Project standard	Lapse on part of programmer in following the Project standards.
6	Value for WS-END-OF-IRLHQ should be 'NO ' not 'NO'	Unclear Specifications
7	Indentation is not proper	Lapse on part of programmer in following the Project standards.
8	Length of the IPARM record should be 80.	Unclear Specifications

Comparison with Prior months Data:

	F	A	I	T	B	D	G	C	Total Weighted Defects	Month
Weighted Defects	0	2	4	89	0	4	2	0	101	Jun 01
Weighted Defects	0	4	2	27	12	0	10	0	55	Jul 01

Prevention Action proposed :

Root causes:
It has been observed that the adherence to standards is not strict resulting in most of the documentation type of defects.

Proposed action with justification:
A tool had been developed last month to catch documentation type of errors and this has helped a lot in reducing the number of documentation type of defects. Continue using the tool and observe if there is further reduction in defects.

- Responsible persons: Person A, Person B, and Person C.
- Proposed review date : Next months Causal Analysis
- Action applicable for current project : Yes
- Action applicable for other project : No

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