Reliability management improvements : a feedback mechanism to learn from design changes

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Executive Summary

Introduction

Reliability Management is an important research area of the Philips CFT Reliability group and the section 'Quality of Products and Processes' from the Eindhoven University of Technology. Many methods, tools and techniques are developed, which are use during projects to support Philips Product Divisions with their Reliability Management.

Methods and tools use to be been developed in line with zero-defect design; the thought to make a product which no defects. To achieve zero-defect design organisations should know their customers, the customers requirements, the product, the processes to produce the products and even their suppliers. All these criteria can only be fulfilled in a static environment, in which sophisticated learning is not a must. However, in the nowadays dynamic markets collective learning is essential in order to stay competitive.

Within the Product Creation Process (PCP) several sources of quality information are giving companies the opportunity to re-design their products. Re-design involves changes on the previous product design. These product design changes are a major source for learning opportunities. The lessons that can and should be learnt from changes can identify areas to improve the feedback mechanism within the PCP. A case study has been executed at Philips DAP Drachten in order to analyse the technical change feedback mechanism within its PCP.

Assignment

The assignment definition of the case-study executed at Philips DAP Drachten has been defined as:

> *Identify bottlenecks in the feedback mechanism within Reliability Management, with as focus how to learn as a company from changes, and give recommendations about where and how the most valuable improvements can be made.*

Root causes of reliability problems are twofold, a technical or an organisational root cause. Looking at the organisational part, the root cause can be the way the development process is organised or the way the valuable information is deployed to the right persons. Technical Changes are covering both root cause. A Technical Change is written to solve a technical problem, but can indirectly pin-point an underlying organisational bottleneck.

Feedback Mechanism

Regarding the second research question, *how should organisations learn in a structural and efficient way*, Wheelwright and Clark [Wheel92] developed a framework for focusing the organisation's attention on potential opportunities for learning and thus for improvement. Systematically exploring the underlying sources of both problems and the things that went right gives insight into ways that the organisation may change in order to improve itself.
Five crucial themes have been identified in successful systematic learning [Wheel92]:

1. **Learning as a team;**
2. **A model of the process;**
3. **Data and Analyses;**
4. **Search for Patterns;**
5. **Root causes.**

In relation with the second crucial theme of the learning framework a generic model of the Feedback Mechanism within Reliability Management has been defined and is depicted in figure A.

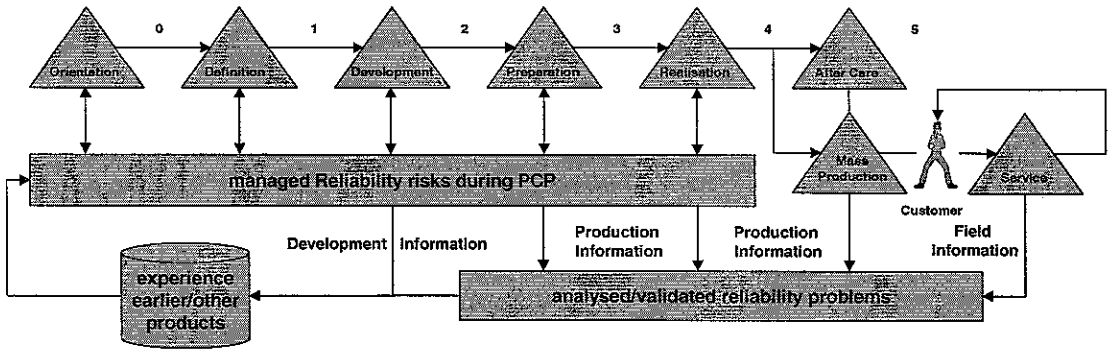

figure A: Feedback Mechanism within Reliability Management [CFT Reliability Group brochure]

Reducing reliability risks can be done in a corrective or preventive way. The corrective approach to reduce reliability risk is used to solve problems that already have occurred. The feedback information flow, based on structural resolve activities, should go to product development projects that are between design phase and mass production.
While reacting on reliability problems, one should not only make changes in current products, but also use experience to improve future products. The second feedback information flow (preventive), based on all design information, should go to product development projects that still need to be started. Design information and quality information should be evaluated and used in the earlier phases of future product development projects, for example during FMEA sessions and at the decision making process during development in order to establish the pre-control.

Understandable is that factors like the amount, the quality and time it takes to obtain and deploy feedback information, will play a vital role in the effectiveness of the Feedback Mechanism.

Assessment Feedback Mechanism

Three research questions inline with the assignment definition and based on the third, fourth and fifth crucial theme of the learning framework, have been defined and answered in order to measure and validate the performance of the current feedback mechanism and improvement actions regarding the feedback mechanism:

1. *How does the Feedback Mechanism, based on Technical Changes, look like at Philips DAP Drachten?*
2. *Does Philips DAP Drachten use4 the information, related to Technical Changes, in order to prevent the re-occurrence of these problems?*
3. *Is the information, related to Technical Changes, documented and deployed in such a way the whole company can learn from it?*
4. *What action needs to be taken to improve the feedback mechanism in order to learn as a company from Technical changes?*

Findings Assessment

Technical Change feedback

- A structural information flow is missing, which can be explained by the following two observations. First, along the way changes on a particular component within a product development project are not structurally communicated to other related projects. Secondly, due to the structural time-pressure at the back-end of the product development projects, and the directly transfer of resource from almost finished project to new start-up projects, no exact correct final archiving of the CAD-file is done. This fact is not communicated to projects, which will use the CAD-file in the future.

Pre-control

- The feedback mechanism within Reliability Management at Philips DAP Drachten consist at this moment mainly of the experience/memory of the employees. At the start-up of a product development project employees who worked at the predecessor shaver are, if possible, assigned to the new project;

- The other feedback mechanisms opportunities to establish a better pre-control, TCPs, design rules and design history, are not used by Philips DAP Drachten;

- General speaking, in the last two years no design rules have been documented by developers and even the available design rules are not used during development.

Feedback Information

- The current way of documentation, in specific correctness and completeness, is not done in such a way the organisation can use the available information in order to learn from Technical Changes;

- The time it takes to obtain and to deploy information to relevant people is effected by the possibility to search efficient in the available information. PRODOC and the design rule database has no possibility to search for a specific group of TCPs;

- Feedback Information flow is supported by stand alone database/files. Remarkable is that there is even no central root cause database and a sophisticated design history database. Design and production quality problems are documented, but there is no link between the problems, root causes and TCPs;

- The structure of the design database is not very clear. Some design rules are place under heading where you would not search for them. Also the way to access the database is not clear communicated to everyone.

Continuous Improvement

- Root-causes of particular failures are investigated in a technical sense, but also in a structural way in an organisational sense;

- Players in the PCP recognised and discussed upon the root causes, but no specific action had been taken to eliminate the root causes;

- There is nobody specific assigned as process owner and no specific performance indicator has been used to evaluate the Feedback Mechanism performance.

Recommendations

Technical Change feedback

- ***Create link between related CAD-files***
  The re-use of concepts or components by successors needs to be supported by a structural process in order to prevent problems. Adding related 12 NC numbers to CAD-files would offer a visual link between product development projects. In this situation the process goes from a pull process to a push process. In stead of checking (pull) every time to make sure the predecessor has not been changed, the predecessor informs when something has been changed (push).

Pre-control

- ***TCPs evaluation***
  An evaluation based on TCPs should be part of an evaluation meeting. This will provide better tacit knowledge for the Reliability activities in the start-up phase of successor product development projects;

- ***Create design rules***
  In order to create a design rule database that will be use during development, design rules have to be formulated with involvement of the relevant parties. Discussion on TCPs and personal insights during module group meetings will result in an accepted and correct design rule database;

- ***Create design history database***
  All design information, CAD-files, TCPs, root causes and correction of calculations are very valuable for next generations of product development projects. A more structural documentation of this information in a database is recommended.

Feedback Information

- ***Create link between databases***
  All feedback information should documented in such a way that the link between failure/symptom, root cause and created changes can be found back in an efficient way;

- ***Improve TCP data storage to improve search engine***
  In order to extract in a more efficient way group of TCPs a better search engine needs to be created. Several changes have to be made to improve the current TCP data storage. The possibility to search on 12 NC, root cause, particular team module group team needs to be created;

Continuous Improvement

- ***Search for patterns***
  The developers themselves should indicate during the creation of TCPs and the evaluation of design history problem areas within the development business process (PCP). The information should picked up and translated in improvement actions;

- ***Process ownership & Feedback Mechanism performance indicator***
  Clear is that a Feedback Mechanism owner is needed who evaluates and stimulates the improvement of the performance of the Feedback Mechanism.
  Besides the Field Call Rate (FCR) and Fall-Off-Rate (FOR) another performance indicator should by defined. The number of changes and the change creation date within the PCP is a measurement for the maturity of the PCP.

Report

This report:

- provides an overview of the assignment set-up;
- highlights the theoretical background regarding the assignment;
- described the perceived and current Feedback Mechanism within Reliability Management at Philips DAP Drachten;
- puts forward recommendations how Philips DAP Drachten should improve its Feedback Mechanism.

The report begins with a chapter providing information on the assignment. In chapter 1 a quick scan of the situation at Philips DAP Drachten regarding the assignment is given in order to be able to place the problem definition. The assignment definition and assignment objective are highlighted as well. The later part of chapter 1 addresses the specific assignment approach.
In order to executed the assignment in the right context the work environment, Philips DAP Drachten and its core business, are examined in a nutshell and will be described in chapter 2.
A research on available literature is needed to understand the background of the assignment and to answer the first two assignment questions. The literature review is presented in chapter 3 and will highlight the key words stated in chapter 1; Product Creation Process (PCP), Reliability Management, information and last but not least learning.
In order to be able to identify potential improvement opportunities a model of the current Feedback mechanism. Therefore, based on Reliability Management at Philips DAP Drachten, the available feedback information and the current Technical Change Management the perceived Feedback Mechanism is presented and described in the last section of chapter 4.
A qualitative analysis, to measure the performance of the Feedback Mechanism is described in chapter 5. The feedback based on Technical Change Proposals will be analysed and the quality of the feedback information will be determined by analysing the feedback information on documentation and deployment.
Based on chapter 4 and chapter 5 the current Feedback Mechanism, a re-design of the Feedback Mechanism a

Within the Product Creation Process (PCP) several sources of quality information are giving companies the opportunity to re-design their products. The lessons that could be learnt from design changes, but which are not picked up by the organisation, identify areas to improve the feedback mechanism within the PCP.

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