

INF5181 – Process Improvement and Agile Methods in Systems Development

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1 Introduction

1.1 Purpose and structure

The purpose of the document is to propose process changes to a defined case of software engineering and how these changes will be implemented and measured.

The document describes context for the case, the current and the proposed process, implementation of the target process, measurement and control, and a concluding discussion of rationale and risk for the proposed process.

1.2 Context description

The company is a major IT vendor and consultancy company organized with business verticals and delivery horizontals called professional services. The business verticals are responsible for sales, marketing and business strategies. The business verticals are organized by market segments like *Utility, Oil and Gas, Public Sector* and *Finance*. The delivery horizontals are responsible for product development, consultancy and customer support. Ideally the horizontals are generic and not related to a specific business but for the time being there are delivery horizontals for specific business verticals. The company has an ongoing reorganization process towards a matrix organization.

The case for this project is from the business vertical *Utility*. The delivery horizontal is dedicated for this market segment and is organized in three units; consultancy department, software development department and customer support department. The software process are conducted by the software development department but uses also resources from the other two departments in the horizontal, and sometimes some resources from the business vertical of *Utility*.

The business vertical develops and delivers a billing system for the utility business in Norway. They do also have complementary products for the business but the billing system is core product.

1.3 Method

Making this project report I have used parts of the activities in the PROFES method (PROFES, 1999). In the real life these activities should be conducted with proper participation from the organization.

This table shows what activities from PROFES I have done in order to make this project report.

Characterize	Verify commitment	<ul style="list-style-type: none"> • Define organizational context • Identified the organizations business needs and improvement objectives
	Identify product quality needs	<ul style="list-style-type: none"> • Document product quality needs • Set preliminary product quality goals
	Determine current product quality	<ul style="list-style-type: none"> • Evaluate current status of product quality. <i>Note: Done by quantitative measures of usability</i>
	Determine current process capability	<ul style="list-style-type: none"> • <i>Note: I have judged the process capability by using the quantitative product measures as indicators. I have also used customer feedback from bid competitions as indicators of process capability</i>
Set goals	Set product improvement goals	<ul style="list-style-type: none"> • Identify product improvement areas • Set product improvement goals
	Determine necessary process changes	<ul style="list-style-type: none"> • Identify processes to be improved • Select improvement actions
Plan	Describe process changes	<ul style="list-style-type: none"> • Mark processes/ practices in current process model, which have to be changed • Develop descriptive process model
	Set metrics for the processes and product	<ul style="list-style-type: none"> • Define measurement goals
	Prepare improvement implementation	<ul style="list-style-type: none"> • Make time planning and resource allocation

Table 1 PROFES activities used in the report

In addition I have also used the goal orientation principles from the GQM method (Solingen, R., Berghout E., 1999).

Some of the considerations are also based on other process improvement literature.

By principles, given the plan for measurements and the evaluation of the SPI initiatives, I have also used *Deming's Cycle* for process improvement.

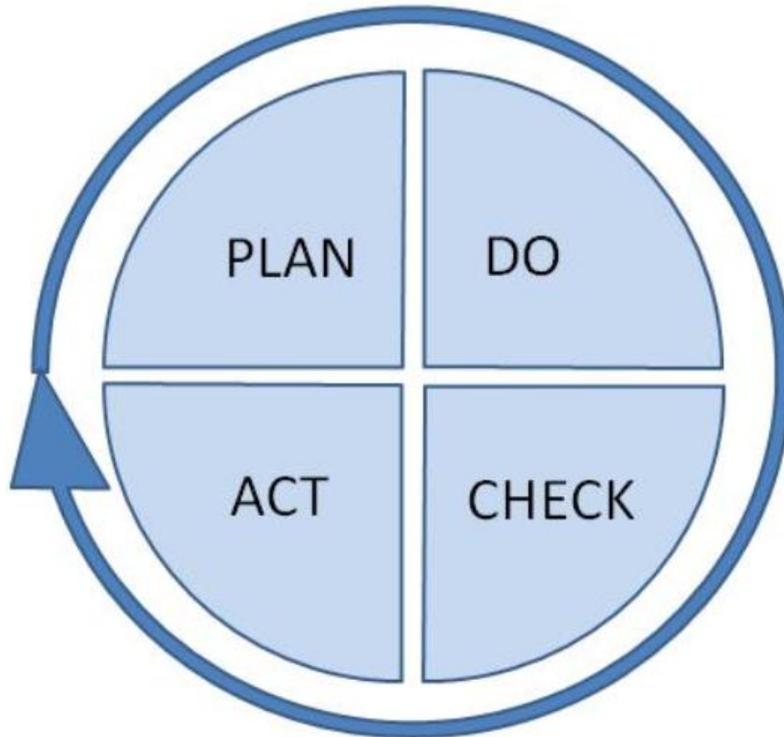


Figure 1 Deming's Cycle

1.4 Issues

The main issue for the business is challenges with poor usability. During the last years the business vertical has lost literally all important bid competitions in the Norwegian market. High price and poor usability have been given as feedback from the customers when evaluating the company's bids. The *SPI Systems Model* (Andreas Birk, Dietmar Pfahl, 2002) describes the relation between business goals and project goals and do also have a well defined link to strategic management.

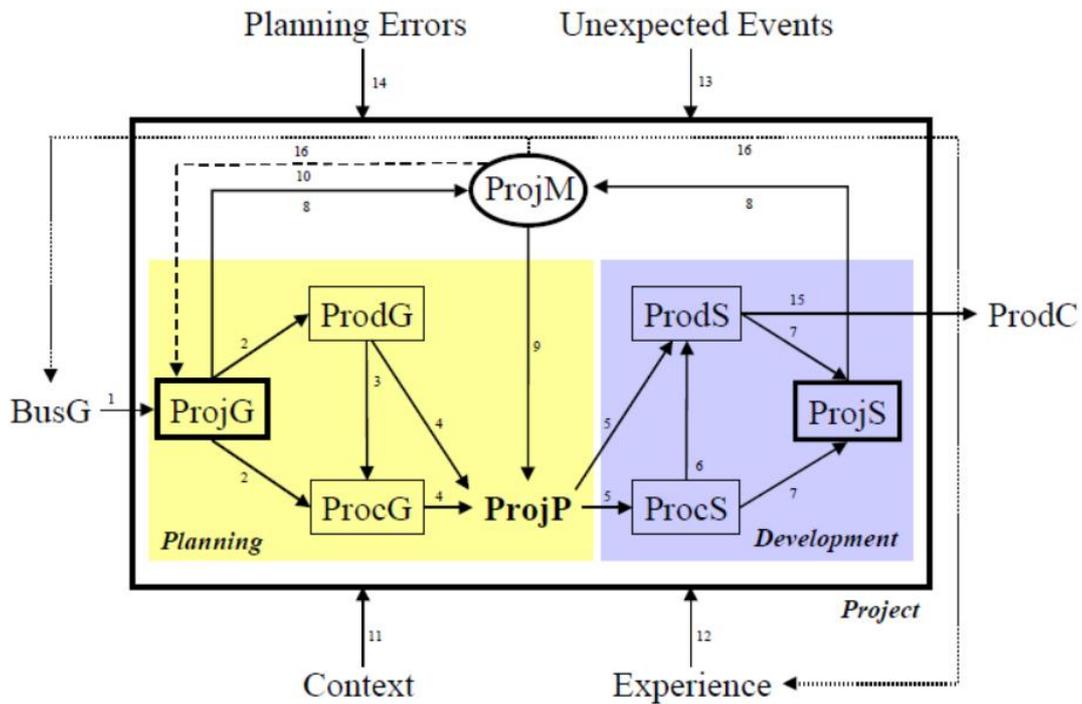


Figure 2 SPI Systems Model with single loop and double loop feedback

This business situation of the company is the trigger for this SPI initiative. To achieve business goals it is necessary to do process improvements to achieve product and project goals.

In my opinion the essential problem is the product's usability because cost is relative to quality. By increasing quality I think cost will not be a significant issue because the customers will get a higher return on investments (ROI).

Given that the company already have started to modernize the user interface of the billing system, this project report will focus on the process of analysis and design of the user interface.

1.5 Goals

Goals of the process improvement are related to product usability:

- Time to complete customer calls shall be reduced to 3 minutes in average
- 9 out of 10 customer care employees shall be able to complete system updates while talking to the customer
- Average score from evaluation after training shall be 90 %

See next chapter for performance of the baseline process.

2 Baseline process

2.1 Elements of the baseline process

This table shows activities, artefacts, roles and methods in the descriptive process model of the baseline process. In the actual process some activities and artefacts are omitted sometime.

Activity	Input	Output	Roles	Methods
Define Project		Project Handbook	Project Manager	
Plan Project	Project Handbook	Project Plan	Project Manager	Work Breakdown Structures
Business Analysis		software requirement specification	Business Analyst	Interviews
Solution Design	Software requirement specification	Solution proposal	Solution Designer	Document inspections Clarifications with Business Analyst Mock ups Reviews
Quality Assurance	Software requirement specification and solution proposal	Review remarks	All involved roles in the project	Individual preparation and common meeting
Estimation	Software requirement specification and solution proposal	Estimates	Architect	Bottom up estimates based on experience data
Quality Assurance	Estimates	Review remarks	All involved roles in the project	Individual preparation and common meeting
Test specification	Software requirement specification and solution proposal	Test specification	Tester	Guided by test specification template
Quality Assurance	Test specification	Review remarks	Solution Designer, tester, architect	Individual preparation and common meeting
Architecture & Design	Software requirement specification and solution proposal	Work assignment specification	Architect	Document inspection Database modelling UML

Activity	Input	Output	Roles	Methods
				modelling
Quality Assurance	Work assignment specification	Review remarks	Architect and programmer	Individual preparation and common meeting
Programming	Software requirement specification, solution proposal and work assignment specification	Program Code	Programmer	Document inspection Clarifications with architect
Test	Test specification	Test specification	Tester	Document inspection Clarifications with Business Analyst and Solution Designer SOAP UI for automated tests
Packing and delivery	Source Control System	Program package	Technician	N/A

Table 2 Baseline process

In addition the projects have recurring status meetings giving meeting minutes as output.

The process has these roles and responsibilities.

- Project Manager
Responsible for project planning, tracking, and status reporting to project owner. Day to day management of project resources and their activities
- Business Analyst
Responsible for business analysis and for making requirement specification
- Solution Designer
Responsible for making solution proposals
- Architect
Responsible for making system architecture, or changes to existing system architecture, and to make work assignment specification for the programmers
- Programmer
Responsible for programming and unit testing

- Tester
Responsible for making test specifications and for performing tests
- Technician
Responsible for packaging and distribution for the new or changed software components

2.1.1 Methods/techniques/tools

Business analyses (when done) are mostly conducted as open ended interviews with customer representatives. Sometimes business analyses are done without customer interaction, but with document hearings subsequent of the internal process of analysis and QA. It has occurred that business analysis and software requirement specification are omitted in the process. Business processes are sometimes modeled using use cases and use case diagrams. Business requirements are described in a structured manner with *title, description, rationale, source, test criteria* and *supplementary information*.

Solution design is often made as verbal presentations sometimes supported by mock ups of user interfaces. Some solution designers also use database models and data dictionary descriptions in their solution proposals. Others make solution proposals with only verbal descriptions of the solution. The solution designer makes a draft and conducts one or several reviews with customer representatives and internal resources. Review with customers is sometimes omitted.

In the architecture and design work it is mainly used verbal descriptions, database models and sometimes UML diagrams. Change objects (program code and database tables) are identified and changes described structured in a table in a text document.

The programmers use their development tools, source control systems and case management systems.

Testing is basically manual but some automated tests exist. Test specifications are organized as test cases and documented in a text document. Testers also use case management systems for administration and documentation.

2.2 Performance of the baseline process

Performance of the baseline process is measured by the usability of the five most frequent used functions in the billing system:

1. Register product changes; purchase, termination and change of delivery address
2. Register meter read
3. Register payment postponement
4. Answering questions regarding invoices and payments
5. Send copy of invoice to customers

These five functions are used in approximately 80 % of the customer care employees working time.

Measurements have shown that:

- Only 6 out of 10 customer care employees are able to complete system updates while talking to the customer. Measurements done with employees with more than 6 months of experience doing the five functions described above
- Average time for a customer care call is 4.5 minutes where updating the system is identified as a bottle neck. Measurements done with employees with more than 6 months of experience doing the five functions described above
- Average score from evaluations after training courses are 65 %. Measured by giving participants tasks with the five functions described above to complete in the billing system

3 Target process

3.1 Target Process

The main changes of the process are:

- Bringing in formal competences in requirement analysis and design of user interfaces
- New methodology for requirement analysis
- New methodology for user interface design; interaction design, graphical design and information architecture design

Another significant change is to increase customer/user participation.

The company has a successful group of interaction designers working with web based interfaces winning a lot of design prizes for their products. As a change of the software engineering process related to interaction design I will propose to use these skilled resources and their defined process in analysis and design of user interface of the billing system.

The complete process described in a table format. Changes are highlighted with colour.

Activity	Input	Output	Roles	Methods
Define Project		Project Handbook	Project Manager	
Plan Project	Project Handbook	Project Plan	Project Manager	Work Breakdown Structures
Analysis	Project Handbook	Personas - a description of users of the system and user stories	Interaction designer, users, application consultants	Personas - identifying and describing fictive users of the system. Describing user stories to each

Activity	Input	Output	Roles	Methods
				personas
Concept	Personas and user stories	HTML prototype of design Concept	Interaction designer, application consultants	Prototyping
Design	Personas, user stories, HTML prototype of design concept	HTML prototype of design and interaction	Interaction designer, users, application consultants	Prototyping and test of prototypes
Architecture & Design	HTML prototype and personas	Work Assignment Specification	Architect	Document inspection Database modelling UML modelling
Quality Assurance	Work assignment specification	Review remarks	Architect and programmer	Individual preparation and common meeting
Programming	HTML prototype and work assignment specification	Program Code	Programmer	Document inspection Clarifications with architect and interaction designer
Test	Test specification and HTML prototype	Test specification	Tester	Document inspection Clarifications with Business Analyst and Interaction Designer SOAP UI for automated tests
Packing and delivery	Source Control System	Program package	Technician	N/A

Table 3 Target process

Roles in the process:

- Project Manager
Responsible for project planning, tracking, and status reporting to project owner. Day to day management of project resources and their activities
- Interaction designer
Responsible for analysis, concept design, graphical design, interaction design and information architecture. Also responsible for testing of the different design elements
- Application consultant
Responsible for ensuring that new interface design complies with the business logic of the application. Also responsible for testing of usability and business logic
- Architect
Responsible for making system architecture, or changes to existing system architecture, and to make work assignment specification for the programmers
- Programmer
Responsible for programming and unit testing
- Customer/user
Participates in analysis and testing
- Tester
Responsible for making test specifications and for performing tests
- Technician
Responsible for packaging and distribution for the new or changed software components

In this case the business logic in the billing system exists and shall not be changed. Hence it is necessary to involve application consultants in the design work to verify that the proposals for new user interface are in compliance with the business logic. In addition the application consultants also have good knowledge of the customers' use of the billing system and hence can give valuable contributions also in that respect.

This process model is quite disciplined and not that agile. I have chosen to keep the process quite disciplined due to the size of the group, and especially due to the fact that project group are geographically spread; Oslo, Haugesund, Tønsberg and Sarpsborg. According to *Allistair Cockburn* (Cockburn, 2000) larger groups should have larger methodologies. In this project there will participate up to ten project members at the same time. He also argues that face-to-face communication is the best way of communicating. To mitigate for the fact that face-to-face communication in this project often will be difficult to arrange, I have chosen to propose a more disciplined model with formal documents and prototypes.

4 Implementation of target process

The main matter in this process improvement proposal is to convince the management of professional services for Utility that the proposed process will improve the product quality and help to achieve the business goals. The

improvement proposal will be presented for the management of professional services of Utility. The management of the UX group will be given a central role in arguing why these changes will be a significant contribution to the process quality and hence to the product quality. The management of the Utility vertical will also participate in the presentation of the improvement proposal since this unit is responsible for achieving the business goals for the sector.

Next the professional services management have to convince the programmers and system architects about the process changes. We know that the programmers and systems architects wish to participate in the design work, even though they do not have any formal skills in interaction design. Presumably there will be some dissatisfaction with these changes in that group.

This table shows the activities which will be carried out to implement the process improvement.

What	When	Who (by whom)	How
Present improvement proposal to management of professional services and the Utility vertical	As soon as possible	UX management	Meeting
Allocate design resources from the UX group	As soon as decision is made	Project manager	Resource request
Present the decided changes to programmers and system architects	After decision of changes	Project and line management	Meeting
Re-organize the project to include interaction designers	Next development iteration	Project manager	Project meeting

Table 4 Implementation plan

5 Measurement and control

5.1 Measurement plan

Based on the GQM method (Solingen, R., Berghout E., 1999) the main software characteristic for this process improvement will be usability.

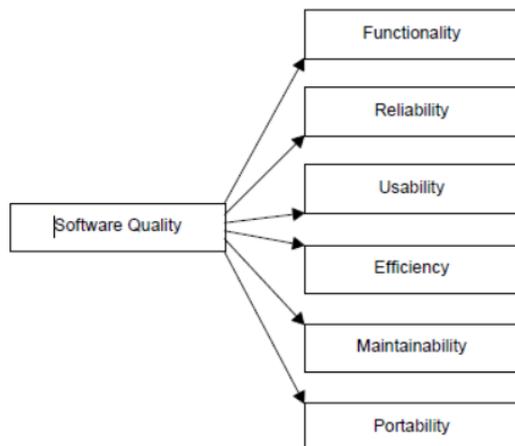


Figure 3 ISO 9126 software quality characteristics (ISO9126, 1992)

The main process improvement focus is on quality (usability).

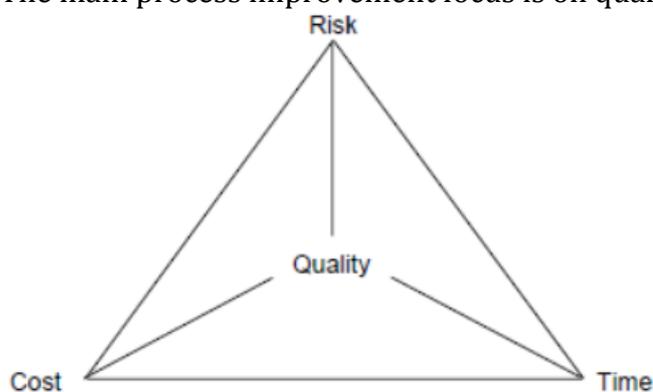


Figure 4 Process improvement focus

These goals defined in chapter 1.5 Goals

- **Time to complete** customer calls shall be reduced to 3,5 minutes in average
- **9 out of 10** customer care employees shall be able to complete system updates while talking to the customer
- **Average score** from evaluation after training shall be 90 % will be measured by this plan:

	Time to complete	9 out of 10	Average score
Measurement unit	Minutes	Amount	Score points
Element of process	Analysis, Concept and Design	Analysis, Concept and Design	Analysis, Concept and Design
When	After three months use of new user interface	After three months use of new user interface	After three months use of new user interface
By whom	Customers	Vendor	Vendor
How	By measuring average customer call time over two weeks using their telephony system	Observation of customer care employees in minimum three customer care	"Exam" after standard training course in new user interface

	Time to complete	9 out of 10	Average score
		centers counting how many are able to complete system updates while talking to customers	
Responsible	Vendors product owner	Vendors product owner	Vendors product owner
Control responsible	Customers manager of customer care service	Customers manager of customer care service	Customers manager of customer care service
Tools	Telephony system	N/A	Billing system

Table 5 Measurement Plan

5.2 Action plan

The measurements will be reviewed and evaluated both with a representative selection of managers and employees from customer care centers and internally with the business vertical and the professional services participating.

Depending on the actual outcome of the measurements these actions will be taken:

- **Goals are achieved**

Together with the customers there will be a discussion if the product improvements are sufficient to achieve their strategic and operational business goals. If not we will have to start another iteration of process and hence product improvements to stay competitive in the market.

Internally the business vertical has to consider whether the results are sufficient to reach their strategic business goals or not. This of course based on feedback from the evaluation together with the customers

- **Goals are not achieved**

If the goals are not achieved we will have to evaluate if the SPI initiatives were appropriate or not. It might be that the process improvements were appropriate but that it is necessary to do another iteration of product improvements, which will be quite normal for this kind of methodology

These evaluations comply with the *Check* stage of *Deming's Cycle*.

6 Discussion

6.1 Underlying rationale of proposed changes

The proposed changes are based on positive experience from cooperating with the UX group in a re-design process of a self service portal for energy customers.

It is also based on the principles of the company's re-organization from late January this year; working as a matrix organization utilizing all the best resources across different business segments.

Also the UX group's track record of very good results from several development projects is of course a major reason why I propose to use these resources and their process for the design of the user interface.

Basically I do also believe that formal competence in the different disciplines of the software engineering process makes a difference.

My alternative was to propose that the software architects and programmers (without formal skills in interaction design) should do the design work and to use the interaction designers as advisors and for quality assurance. This was in fact the actual process of the first iteration of the project, judged as no success by the interaction designers; which in fact denies any further participation in the project if one should use this process.

6.2 Risks of proposed changes

The main risk is dissatisfaction among system architects and programmers wanting to do interaction design. When starting this project a year ago the interaction design work was used as a motivator for these employees. The consequences can be in the range of expressed dissatisfaction and maybe reduced productivity to employees quitting their job.

The risk mitigation strategy is to have an open dialog with these employees explaining why these process changes are done and to emphasize their importance to the project as skilled system architects and programmers.

7 Works Cited

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