Design of Standard Operating Procedure for Requirement Engineering in Software Development: Case Study Data Processing Integration Subdirectorate Statistics Indonesia

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Design of Standard Operating Procedure for Requirement Engineering in Software Development: Case Study Data Processing Integration Subdirectorate Statistics Indonesia

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Abstract. A design of Standard Operating Procedure in software development has been produced. SOP for Requirement Engineering was designed using modified Soft Systems Methodology (SSM). Scrum method is used as an approach. Interview with thematic analysis was also conducted to determine the needs of Requirement Engineering SOP. The design of Requirement Engineering SOP consists of three steps: Initiation, Development, and Iteration Planning. With the design of requirement engineering SOP, frequently changing requirements problems in application development can be solved.

1. Introduction

Standard Operating Procedure (SOP) are formal document that explains how individuals or organizations perform tasks and document the execution of tasks[11]. SOP include step-by-step detailed instructions of the process and instructions aimed to at execute activities consistently[12]. Statistics Indonesia conducts census or surveys to produce statistics. In census or surveys, data processing is important like the other stages (data collection, data analysis, and data dissemination). Data Processing Integration Subdirectorate is responsible for data processing activities that include data recording, data cleansing, and data tabulation processes. They develop software independently but the software has a number of patches.

Those patches are existed due to bugs in the software as well as their requirements change from the user. Bugs in the software are also due to frequently changing requirements. Frequently changing requirements with limited time development lead testing process couldn't be carried out thoroughly. The problems that happened in the data processing stage, can have an impact to the next stage of the census or surveys.

Data Processing Integration Subdirectorate does not have a complete SOP for application development, especially for requirement engineering related to the frequently changing requirements. This paper aimed to develop design of Requirement Engineering SOP in software development at Data Processing Integration Subdirectorate.

2. Requirement Engineering

Requirement engineering is the process of understanding and defining what services are required from the system and identifying the constraints on the system's operation and development[3]. The requirements engineering process aims to produce an agreed document that specifies a system that satisfies the stakeholder requirements[3]. There are four main activities in the requirements engineering process[3]:

1) Feasibility study
2) Requirements elicitation and analysis
3) Requirement specification

4) Requirement validation

In Agile, such as Scrum, requirements engineering activities can be productive by increasing customer satisfaction and often provide working software, by using user stories with a bit process of formal documentation[2]. Requirements in agile methods developed incrementally according to user priorities and the elicitation of requirements comes from users who are part of the development team[3]. In Agile, such as Scrum, non-functional requirements can be represented in the user stories[8].

3. Soft System Methodology

Soft System Methodolgy (SSM) is an action-oriented process of figuring out problematic situations from everyday real life[6]. The users of SSM start learning by recognizing situations to formulate funds or take action to rectify the problematic situation[6]. The learning process occurs through an organized process in which real situations are explored, using the intellectual tools that enable directed discussions, called a number of models of purposeful activity that builds on a number of points of view (worldviews)[6]. SSM consists of seven steps in Figure 1.

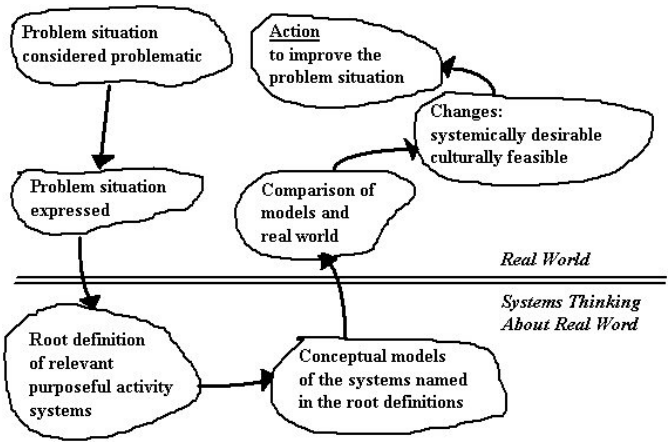

Figure 1. The Seven Steps of Soft System Methodology (SSM)[5]

Step 1. Identification of real world situation that considered as problematic[9]. This stage is important because related to the decision to changes, repair, or improve the problematic situation.
Step 2. Problem situation expressed into rich picture[9]. The purpose is to recognize the real-world situation from the organizations. Rich picture is a tool to describe as much as possible information related to the situation in the real world problems.
Step 3. Root definition of relevant purposeful activity[9]. In this stage some relevant systems of human activity, which potentially offer an understanding problem situation, and root definitions are built[1]. The general formula recommended for developing root definition is the PQR formula. The root definition needs to be tested and refined by analysis tool, CATWOE.
Step 4. Conceptual models of the systems named in the root definitions[9]. This stage is the stage of making a conceptual model based on the root definition that has been selected and named at an earlier stage. This is the most important step in SSM, various modeling techniques can be applied to this step[1].
Step 5. Comparison of model and real world[9]. This stage is not only intended to compare, but also manage discussions about real-world situations that made possible the emergence of various viewpoints that had been hidden. By the emergence of various viewpoints, is expected to appear the formulation of suggested steps for corrective action, improvement and change in real world situations.
Step 6. Changes systematically desirable, culturally, feasible[9]. This is the stage of suggestions formulation for improvements, enhancements and changes in real world situations. There are two important considerations for possible changes in the real world arguably and systematically desirable and culturally feasible.

Step 7. Action to improve situation[9]. This stage is the action steps for improvement, enhancements and changes in problematic situations. At this stage, various activities are held to implement and fix the model[1]. In this step, the conclusions is taken and long-term solution is formulated[1].

4. Scrum

Agile is the most suitable method for software development where the system needs to change rapidly during the development process[7]. Agile methods are intended to produce software that can be used quickly by the customer, then propose new or changed requirements to be included in the next iteration of the system[7]. Agile method aims to reduce the bureaucratic process and eliminate documentation that may never be used[7].

Scrum is one of the most popular agile methods[10]. Scrum is a framework in which people can overcome the adaptive and complex problem, but still able to productively and creatively delivering products with the highest possible value[4]. Scrum implements an iterative and incremental framework through three roles: Product Owner, Scrum Team and Scrum Master. Product backlog is a list of functional and nonfunctional requirements, which when transformed into features will deliver the vision. Product backlog is prioritized items that most likely generate value, top priority and is divided into several proposed release. The whole work is done in the Sprint. Each Sprint is an iteration of 30 calendar days. Every day in Sprint, the team will be together for a meeting to 15 minutes, called the Daily Scrum. The purpose of this meeting is to harmonize the daily work of all the team members and to schedule any meetings that required the team to continue the progress. Sprint Review is meant to bring people together and help them collaboratively determine what to do next team. After reviewing Sprint and prior to the next Sprint Planning meeting, the Scrum Master Sprint retrospective meet with the team. Scrum Master encourages the team to revise its development process to make it more effective and enjoyable for the next Sprint. Software incrementally delivered to the customer, so the software functionality that have been implemented could be tested and evaluated by the customer[7].

5. Scrum Body of Knowledge™ (SBOK™)

SBOK™ Guide developed as a standard guide for organizations and professionals who want to implement Scrum, and who have done and want to make the necessary improvements to processes performed[10]. SBOK™ Guide provides a comprehensive framework that includes principles, aspects, and Scrum process. SBOK™ Guide describes 19 Scrum process is grouped into five phases in Table 1.

Table 1. SBOK™ Guide Phases

Phase		Process
Initiate	1.	Create Project Vision
	2.	Identify Scrum Master and Stakeholder(s)
	3.	Form Scrum Team
	4.	Develop Epic
	5.	Create Prioritized Product Backlog
	6.	Conduct Release Planning
Plan and Estimate	7.	Create User Stories
	8.	Approve, Estimate, and Commit User Stories
	9.	Create Task
	10.	Estimate Tasks
	11.	Create Sprint Backlog
Implement	12.	Create Deliverables

	13.	Conduct Daily Standup
	14.	Groom Prioritized Product Backlog
Review and Retrospect	15.	Convene Scrum of Scrum
	16.	Demonstrate and Validate Sprint
	17.	Retrospect Sprint
Release	18.	Ship Deliverables
	19.	Retrospect Project

6. SOP for Requirement Engineering

Step 1. Identification of real world situation that considered as problematic.

The interview was held with several interviewees in order to explore and enrich the understanding of the condition of software development in Data Processing Integration Subdirectorate. The results are processed using thematic analysis. The result is identified as problems in the software development process in Data Processing Integration Subdirectorate.

Step 2. Problem situation expressed into rich picture.

Rich picture describes current conditions and problems to make it easier to understand based on the problems that have been identified from the previous stage.

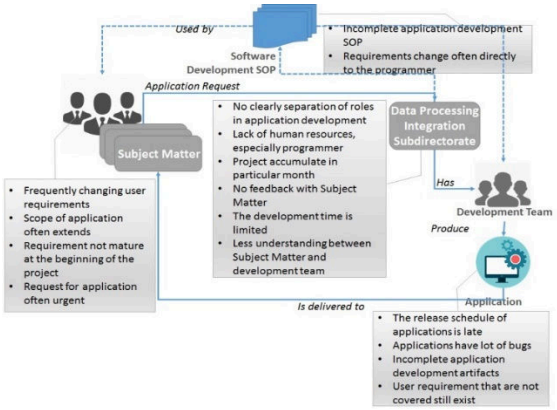

Figure 2. Rich Picture

Step 3. Selection and naming root definition of relevant system.

PQR analysis (also called XYZ analysis) and analysis CATWOE (Customer, Actors, Transformation, Worldview, Owners, Environment Constraints) are used for selection and naming root definition. PQR analysis has the formula "Doing P by Q to achieve R, where PQR answered questions What, How, and Why".

The needs of SOP is identified based on the root definition which has been obtained. The needs of SOP must be in accordance with the root definition that has been created. There were some steps to clarify the process:

1) Identify the needs of the SOP based on the study of literature.
2) Identify SOP needs based on best practice.Identify the needs of the SOP based on previous research.
3) Identify the needs of the SOP based on interviews.

Step 4. Building the conceptual model based on root definition

The conceptual model is designed based on the needs of SOP that obtained from the study of literature, best practice, previous studies, and interviews. This paper did not specify the deliverables creation activities. This is in accordance with the purpose of this research, namely the preparation of requirements engineering SOP. The process needs then grouped according to the phases of the Scrum, in order to obtain a conceptual model as follows:

1) The concept of Requirement Engineering SOP Initiation Phase (Figure 3).
2) The concept of Requirement Engineering SOP Development Phase.
3) The concept of Requirement Engineering SOP Iteration Planning Phase (Figure 4).

Step 5. Comparison between real world and conceptual model

At this stage, validation of the result of SOP concept is done. The first phase of validation is done to ensure compatibility between the concept of requirement engineering SOP with needs of Data Processing Integration Subdirectorate and regulations in the organization.

Step 6. Formulation of recommendations for improvement, enhancements and changes in the real world situation

In this stage, the formulation of suggestion acts for improvements, enhancements and changes to the real world situation is done. Requirements Engineering SOP in accordance with the results of validation that has been done in the previous stage is designed.

7. CONCLUSIONS

Requirement Engineering SOP is required for requirements engineering process on software development in Data Processing Integration Sub-directorate. Soft Systems Methodology (SSM) is used to design the SOP, from problem identification, determine the need for SOP, SOP design, validation, and to make the final design of SOP. Scrum method is used as approach and SOP needs are determined based on the study of literature, best practice, previous studies, and interviews. Requirements Engineering SOP required by Data Processing Integration Subdirectorate consists of 3 SOPs, the Initiation Phase, Development Phase and Iteration Planning Phase. The resulted SOP should follow the format and mechanism of designing SOP in Statistics Indonesia. The design has been validated to the staff and Head of Data Processing Integration Subdirectorate.

For future research, the research can be expanded into software development activity: design, implementation, and testing. A focus group discussion can be held to accelerate the time to reach an agreement when determining the needs of SOP. Validation of the concept using focus group discussion can be held to accelerate the time to reach an agreement. SOP concept validation can also be done through trial implementation on software development projects in the organization. Suggestions for the organization, understanding of the concepts of the Scrum method is needed for the employee involved. It can be done through training. In addition, the commitment and full support, including supervision of the head of the organization to implement a requirement engineering SOP in Data Processing Integration Subdirectorate is also required.

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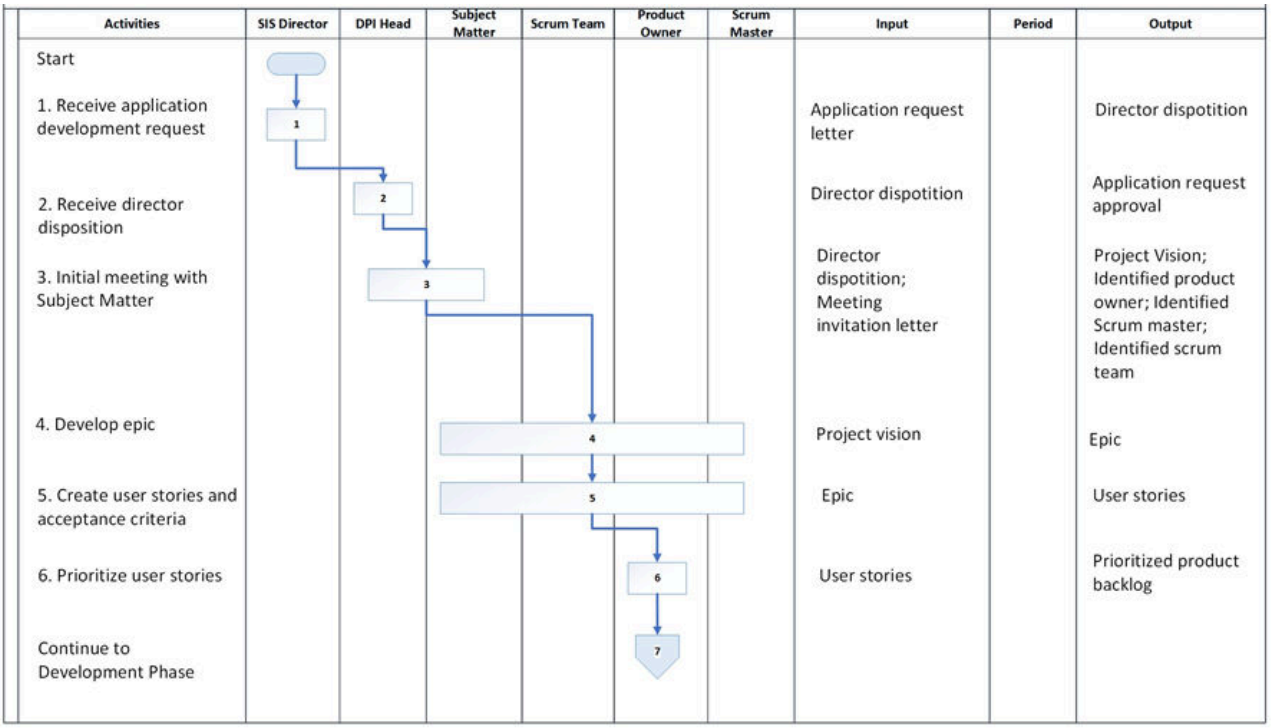

Figure 3. Initiation Phase

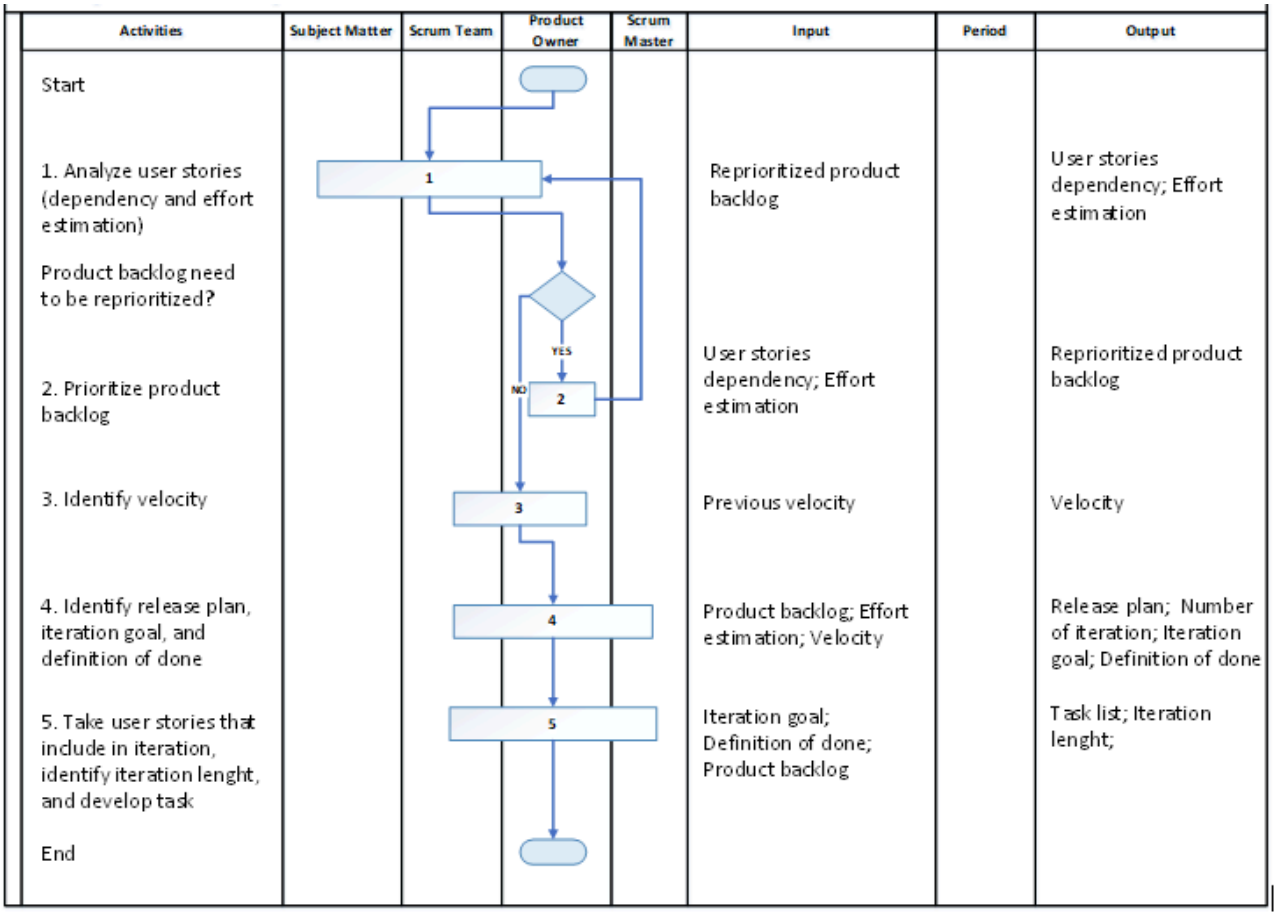

Figure 4. Iteration Planning Phase