Design of Laboratory Management Information System: Case Study National Narcotics Board Republic of Indonesia

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Abstract. Requirement design for the laboratory information management system at the National Narcotics Boards Republic of Indonesia (BNN-RI) has been developed by applying a modified Rational Unified Process methodology that is more adaptive to changing needs than prescriptive process models but still with relatively little cost because not all activities are performed. The design of appropriate requirements of the system is expected to produce useful information that can accelerate laboratory testing services business processes that help Drugs Testing Laboratory in providing service in accordance with the promise of service. The design is done by following a workflow in business modeling and requirements discipline on RUP methodology. The results of this study are business modeling and list of needs contain functional and non functional requirement, which will be implemented in laboratory management information systems. In designing the requirement for the Drugs Testing Laboratory BNN-RI, re-engineering and reconfiguration processes on RUP methodology has been conducted to suit the scale of organization and reduce the required costs.

1. Introduction
In order to bring the criminal to justice, law enforcement officers need evidence. The occurrence of a crime can be proved through physical traces that were found and examined by forensic experts such as fingerprints, sample specimens, DNA, or other physical traces. This also applies to narcotics crime. Narcotics also have special characteristics, composition and the drug-forming compound may be disclosed origin drugs. It is important to understand drug trends in efforts to prove in court.

Act No. 35 of 2009 on Narcotics has set the implementation authority of the arrests were made later than 3x24 hours and can be extended to a maximum of 3x24 hours. To determine the status of the suspect, investigators require proof of examination results of evidence samples, specimens and samples are scientifically as the basis for determining status of the suspect. Without proof of evidence samples as well as samples of scientific specimens, investigators had legal risks in determining the status of a person detained by investigator.

To support criminal investigation of drug, time to complete drugs testing service was set by Head of Drugs Testing Laboratory, which is 3x24 hours. Since December 2015, Drugs Testing Laboratory created intimation service, which stated that the target service time is 4x24 hours. Based on the report of service performance completion report, in 2015 as much as 81.69% of drugs testing services have completion time exceeding 3x24 hours, and in the year 2016 1st semester, 66.24% of drugs testing services have completion time exceeding 4x24 hours. Not achieving these targets may result in delays or legal risks in determining the status of a person held by the investigator. The legal risks that can be experienced by the investigator when determining a person's status without a solid foundation is pre-trial. "The pre-trial objective is to provide a legal assessment of the preliminary investigation of the suspect as referred to in Article 77 of the Criminal Procedure Code,"
whose decisions form the basis for the release of suspects from unlawful arrest and/or detention and demands for redress. The completion achievement of the drugs testing service, is the performance target of the speed of service at Drugs Testing Laboratory. Speed of service is one element in the excellent service. There are 4 (four) main elements contained in the excellent service (service excellence), namely speed, accuracy, convenience, and comfort.

Drugs Testing Laboratory are technical and operational units within the National Narcotics Board in charge of implementing verification and determination of the type of samples or evidence. In addition, the Drugs Testing Laboratory is also serve to civilians through the Deputy of Prevention. Starting in 2009 Drugs Testing Laboratory has been supported by a web-based laboratory information system which shall be used by the personnel in providing drugs testing services. The purpose of the laboratory information system is to facilitate the employee in performing drugs testing services. The existing information system is currently unable to meet the needs of providing drugs testing services on time.

2. Methodology and Design

A. Methodology

![Figure 1. Research methodology](image)

Stages of research conducted adapted to the stage on modified Rational Unified Process (RUP) that starts from identification of problems, literature review, preparing research methodology, data collection, design result analysis, and conclusions and suggestions. Rational Unified Process is a software engineering process development with a disciplined approach managing tasks and responsibilities in a development organization. The goal of RUP is, within a predictable schedule and budget, produce high-quality software that meets the needs of its end users. Each stage consists of input, and the output method to clarify the intent and purpose of these stages.

B. Design

The approach taken to conduct this study is a qualitative approach. Qualitative research is a research method that was developed in the social sciences to enable researchers to study social and cultural phenomenon. A qualitative approach was chosen because the researchers wanted to get an overview of laboratory information management system needs to be designed from stakeholders in full, so that the resulting information system design can meet the needs and solve the problems that have been defined.

Data collection methods used were interviews and observations of the existing operational information system. The requirements design based on the results of data collection is done with the rational unified process. Due to time constraints, the scope of the work is on the disciplines of business modeling and requirements. Not all activities in the workflow was executed, they were adjusted while the requirements design was made.
3. Result and Discussion

Requirements design was conducted in three iterations. In the first iteration researchers conducted interviews with stakeholders and users, then made observations of the existing information systems that have been in operational as triangulation. At each end of the iteration, the researcher described the results of the analysis to get responses from stakeholders and users. Such responses are needed to ensure that the analysis results are correct. In each iteration, the user could provide change request so that researchers were able to improve their designs.

A. Business Modeling

The first stage was to understand the business model. Researchers used business use case and business object model to understand the business model. Based on data collection result, the researchers analyzed that investigators do not interact with the system, but through officers. Activities undertaken by investigators in obtaining laboratory testing services are sending the evidence samples to be tested and taking the result of the evidence sample testing.

In the second iteration there was a change request from stakeholders, that in addition to the two interactions, there were still interactions conducted by the investigator, i.e. calling the laboratory officer as an expert witness in the court. Therefore it can be concluded that there are three interactions, i.e. sending evidence samples, taking the result of the evidence sample testing, and calling as an expert witness.

![Figure 2. Business use case](image)

Investigators from law enforcement can do three things as business actors, sending evidence samples to be tested, taking the results of the evidence sample testing, and calling drugs testing laboratory officers as an expert witness. Generally, details of each business use case is described in the business object model.

![Figure 3. Business object model of “send evidence sample”](image)

Investigators submit evidence samples, which then is accepted by the admissions officers. By the admission officers the samples are submitted to the next services personnel, consisting of measurement officer, drugs testing officers, drugs testing official report officers, and filing officer. All data generates from each section are stored in the database.
When investigators want to take the evidence of sample testing results, admissions officer will coordinate with the filing officer to prepare the drugs testing official report and the rest of the evidence samples that have been tested. The drugs testing official report and the rest of the evidence are received by the investigator from the admissions officer.

When investigators sent an invitation letter to expert witnesses, and then accepted by the administrative staff, the letter handed-over to the Head of the Laboratory to be given disposition. After being given disposition, drugs testing section head will give orders to filing section staff for finding the archive data required.

B. Functional Requirement

Traceability matrix is made to manage requirements, making it easier to trace the requirements. Traceability matrix is made on the document requirement management plan.

Data that has been obtained from interviews and observations are recorded in a stakeholder requests. Stakeholder request is used to determine the needs, feat, SRS, use case and supplementary requirement. The detail definition of the information system functional requirements is described in use cases. In the data collection stage, all actors describe the stakeholder request that must be met by the system to be built. There are seven actors involved in laboratory information systems, ie:

1. Admission officer;
2. Measurement officer;
3. Drugs testing officer;
4. Drugs testing official report officers;
5. Filing officer;
6. Leaders;
7. Administrator.

To facilitate the analysis of functional requirements, then the system use case is made based on the actor. Stakeholder requests that are then specified into non-functional requirements are described in supplementary specification documents. Non-functional problems that are often experienced include slow systems, less attractive appearance and the systems relatively difficult to be used.

![Figure 7. Use case for admission officer](image)

Admission officers are officers who interact directly with the investigator. Based on interviews, admission officers have several request stakeholders, among them is that the system should be able to facilitate in recording receipt, data return documentation of evidence and verification of data reception. Problems often encountered include a long time in data entry request, documentation of evidence and recording of official drug testing report takers and the rest of the evidence is still done manually.

Researchers conduct an analysis of stakeholders request with the stages that have been established, obtained that admission officer can perform application for drugs testing data entry, verify the data and evidence photos, and perform investigator who took the drugs testing official report and the rest of the evidence data entry.

![Figure 8. Use case for measurement officer](image)

Measurement officers are the officer who perform the measurement, sampling and codefication to the sample of evidence received. They have stakeholders request that the system should be able to facilitate them in the recording of data generated from the measurement activities performed. The data to be managed consists of gross measurement data, net weight before sampling and after sampling. The sampling result is then given codefication, thus facilitating the drug testing officer in conducting the sample test.

Researchers conduct an analysis of stakeholders request with the stages that have been established, obtained that measurement officer can perform the measurement, sampling, and codification data entry, and verify them.
Drugs testing officer is an officer who conducts examination of evidence samples with various methods that have been established. They have a stakeholder request system should be able to facilitate the testing process and manage the data generated from the testing activities. The data to be managed are drugs testing result data, profiling tablet data, and new psychoactive substances data found. The problem that is often experienced is the system that runs not yet optimally support drugs testing activity. Activities that should be facilitated by the system, is facilitate the officer to matching of samples received with data contained in the database, and verification of test results.

Researchers conduct an analysis of stakeholders request with the stages that have been established, obtained that drugs testing officer can perform examine the suitability of the samples received and data in database, perform testing results data entry, perform new psychoactive substances data entry, perform tablet profiling data entry, and verify the drugs testing result data.

Drugs testing official report officer is the officer who made the drugs testing official report and the label of the evidence. Problems often encountered include the difficulty of finding archival data softcopy and a long time in making drugs testing official report. From these problems obtained stakeholder request system that can facilitate in creating and managing data testing official testing report. In addition to these difficulties, also obtained stakeholder request system should be able to facilitate the activities of QR Code scan and verification drugs testing official report.

Researchers conduct an analysis of stakeholders request with the stages that have been established, obtained that drugs testing official report officer can perform examine the suitability of the data with the file manually, download a draft of testing official report and evidence’s label, upload the testing official report and evidence’s label file, validating the suitability of QR Code, verify the testing official reports, and evidence’s label.
Filing officer is the officer who do filing and storing drugs testing official report and the rest of the evidence. Problems experienced are all data collection in and out of the safe is done manually. They need a system that can log in and out of the safe with ease, by verifying the outgoing files and entering the safe.

Researchers conduct an analysis of stakeholders' request with the stages that have been established, obtained that filing officer can perform verification of the testing official report and evidence's label that has been filed.

The head of the drugs testing laboratory, the section head of the testing and the head of the general sub-section have the same issue and stakeholder request, therefore are grouped into actor leaders. Leaders find it difficult to obtain accurate data related to testing services, making it difficult to determine the right policies to improve service quality.

Researchers conduct an analysis of stakeholders' request with the stages that have been established, obtained that leaders can use the dashboard, and view reports so they can monitor laboratory performance.

One stakeholder request from the head of the general sub-section is the system permissions should be properly managed by the selected sub-section officer. These stakeholders are determined to be non-functional requirements, but to be met, they must also be translated into functional requirements.

Researchers conduct an analysis of stakeholders' request with the stages that have been established, obtained that there must be an administrator that can manage user and access rights.

C. Non Functional Requirement

Non-functional requirements are categorized according to the instructions of the supplementary specification document in the RUP:
1. Usability:
   The system is easy to use. Users only need two hours to learn how to use the information system
2. Reliability:
• System reliability at least 95%;
• Laboratory management information system can be used 7x24 hours.

3. Performance:
• Accuracy of data is 100%;
• The system can be used by 50 users at the same time;
• Maximum system response time is five seconds;
• Database and application server has at least 8GB of memory;

4. Supportability:
  During the development and maintenance period, laboratory management information system gets support from the development team;

5. Online User Documentation and Help System Requirements:
  User manual is available online;

6. Interfaces
  a. User Interfaces:
  • System uses a web based user interface using HTML 5;
  • System can be accessed using web or mobile browser.
  b. Hardware Interfaces:
  • System runs on computers connected to the network;
  • System must be connected with the QR Code scanner.
  c. Software Interfaces:
  • System running on linux operation system;
  • System can be accessed with linux or windows operation system using browser.
  d. Communications Interfaces:

System runs by utilizing HTTP protocol on port 80.

4. Conclusion
From the overall design process that needs to be done in three iterations we can obtain 7 actors and 21 use cases to meet the functional requirements for the laboratory information management systems. All functional and non-functional requirements that have been described are expected to meet the requirement and therefore solve the problems described in the introduction chapter. At the moment, there is no interaction of business actors with the system, that means there is still a need and change request that can be found. For future work, we can continue the development by repeating the phases that have been prepared and evaluating the designs that have been made.

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