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The Development of E-Procurement System for an IT Consultant Company

Ong Alexander Ang[1] and Arta Moro Sundjaja[2]

[1,2]Information Systems Department, School of Information Systems, Bina Nusantara University
Jln. K. H. Syahdan No. 9, Jakarta Barat 11480, Indonesia
[1]alexanderang.24@gmail.com; [2]asundjaja@binus.edu

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Abstract **-** The research objective was to identify, analyze, and design a procurement information system that was developed by an IT consultant company for their client companies. Data collection techniques used were literature study, field study, document study, learning and trying the existing e-procurement system. Then, it was followed by analysis on general procurement processes using object-oriented analysis with Unified Modeling Language (UML) as tools. The result is a web-based e-procurement application that supports documentation and storage of transaction data. It also generates reports in accordance with company requirements. The main system features are Request Usage Form (RUF), Purchase Request (PR), Purchase Request Summary (PRS), Request for Quotation (RFQ), Quotation, Winner Selection (WS), Purchase Order (PO), and Receive Report (RR). It can be concluded that the developed system can support procurement processes effectively and efficiently, and integrate the inventory and approval system. Integration with inventory system will result in easier stock checking and automated update of goods data in the inventory system. It includes creating item, editing item, and receiving made report document. Integration with approval system will also result in the simpler process of documents approval in the e-procurement system.

Keywords: procurement information system, e-procurement, system development

I. INTRODUCTION

In recent years, it is undeniable that information technology is growing very rapidly. Marhadi (2016) stated that the rapid development of information technology in the last decade had a huge impact on the aspects of people's lives. For example, it was how people communicated and socialized, and how people did business. Only companies that adapted and took advantage of the development of information technology could survive.

Moreover, Ward and Peppard (2002) agreed that the technological environment was changing and expanding faster than ever. It resulted in innovative products and services and facilitated new ways of doing business, and made old products obsolete faster in the process. This explains that, in general, technological developments are changing rapidly over time and producing innovative new products.

There are many advantages of using technology in the company. For example, the transactions can be done online, and data processing is in real-time. Therefore, from the viewpoint of the company, information technology must be owned. Companies are competing to develop and use new, sophisticated, and cutting-edge technologies to maximize performance and win the competition against other companies.

The rapid development of information technology has a significant impact on the business world. It affects the way the company runs its business and the used business model. The positive impact of information technology development is the opportunity for every business actor, either big or small, to compete. This can also create a new market and new business models such as e-commerce, e-marketing, and e-procurement.

One of the projects developed by the IT consultant company is a web-based e-procurement system. E-procurement is the process of purchasing and selling goods or services over the Internet or another network such as electronic data interchange and Enterprise Resources Planning (ERP). In short, e-procurement can be interpreted as part of e-business to perform Internet-based procurement process within a company. E-procurement covers not only the purchase process, but it also includes approval, decision-making, and contracting processes with vendors. E-procurement system is quite common in small and medium enterprises in Indonesia.

According to Chaffey (2009), e-procurement can be defined as the electronic integration and management of all procurement activities. It includes purchase request, authorization, ordering, delivery, and payment between a purchaser and a supplier.

Based on Beauvallet, Boughzala, and Assar (2014), the main advantage of e-procurement includes saving

money, time, and additional workloads that are associated with writing. The conventional procurement process usually involves a lot of paper processing, which consumes a significant amount of time and money. The benefits of e-procurement are not only from time and cost aspect, but it also includes the simplification of the transaction process. Companies can shorten its business processes by cutting out unnecessary activities as conventional procurement processes require a place to gather vendors in the auction process. By using e-procurement, those activities are not needed. Vendors only need to fill out the form listed on the procurement website and the presence of these vendors is not needed.

Augustin, Varisza, and Marshella (2016) conducted the research of e-procurement system in PT Tetap Lancar Mandiri. The scope of the discussed system was not so broad. However, the difference between this research with the others was that the researchers discussed the minimum point of stock for subsequent ordering material to suppliers by using the ROP method. The only field study conducted was the interview with the director of the company.

Moreover, Nugraputra, Jonathan, and Sylvia (2015) analyzed the design of e-procurement system in PT Subaru Sugih Persada. The scope discussed was very limited. The researchers only discussed the vendor registration process, the manufacture of goods ordering letter, goods verification, goods stock update, the process of returns, and payment. The methods used were only document studies and interview with the head of the warehouse.

Meanwhile, Subagja, Prasetya, and Wibowo (2013) analyzed the design of e-procurement system at CV Utama Mandiri. The research had a wide scope consisting of vendor registration process, material checking, material request, material ordering, downpayment, delivery of goods, goods confirmation, material returns, and repayment. The methods included literature studies, interviews, and direct surveys in the company.

From the three researches, it can be concluded that the developed e-procurement system has a significant and positive impact on procurement process in the company. The scope of the research is not too wide. It is because the system built is not too large and the company does not require a large system. However, the data collection method is incomplete because the interview is only done to one interviewee. Supposedly, interviews are done to some interviewees, such as project team members like project manager and developer, or users who directly use the system. Thus, the readers can see the system from different perspectives.

Croom and Brandon-Jones (2007) evaluated the e-procurement implementation and operation across in nine UK public sector organizations. They found the evidence of cost reduction leading to increasing supply availability and leverage in negotiation. They also saw an increased level of communication in knowledge sharing between customers and suppliers. Moreover, they also found the impact e-procurement implementation on the total cost of acquiring goods and services. The cost of processing purchase requisitions was reduced through improvements of the procurement system, and the reduction in maverick purchasing. Price reductions were from increased visibility, compliance, management information, demand aggregation, and leverage in negotiations.

Suryani (2011) analyzed the critical success factor of e-procurement implementation. These factors were project preparation, organizational change, catalog management, alignment of e-procurement strategies and business processes, and maintenance of increased operational efficiency.

The developed e-procurement system by the IT consultant company is not only used inside the company. It is also used as a framework if there are clients that need an e-procurement system. The main purpose of developing a new e-procurement system is to change the programming language from PHP to Java because it is more flexible, especially for the back-end. There are also many features that can be created in Java, but it is not possible to be implemented in PHP. The project also aims to improve system functionality by adding features and eliminating the limitation of used e-procurement systems. Some limitations are the lack of integration with the inventory system to check the stock of available goods, vendor search, manual registration, and the input price of goods in the Request Usage Form (RUF). Moreover, the price of the goods from each vendor is not always the same.

In the development of this system, the company focuses on three elements: integration, interface, and ease of use. The developed system is integrated with other systems in the company such as inventory system and approval system. Integration is related to the approval of documents by e-approval system and validation of goods on the inventory system after the procurement process is completed. Interface element means that interface and navigation in the system must be clear. Moreover, ease of use focuses on the user's ease of learning and using the system.

In system development, the company uses agile software development approach. Agile development is a philosophy and set of guidelines for developing information systems in an unknown and rapidly changing environment. It can be used with any system development methodology (Satzinger, Jackson, & Burd, 2012). The major difference between the traditional SDLC and the agile methodologies is customer collaboration and immediate response to the change (Jeldi & Chavali, 2013).

According to Nuottila, Aaltonen, and Kujala (2016), agile development methods are widely used by business enterprises. However, the adoption of agile development methods has been slow in the public sector. They identified the challenges in the adoption of agile development methods in a governmental organization. The identified challenges were related to documentation, personnel education, experience and commitment, stakeholder communication and involvement, roles in an agile set-up, location of the agile teams, legislation, and complexity of SW architecture and system integration.

Agile development methodology that is used by the company is Scrum. Streule, Miserini, Bartlome, Klippel, and Garcia de Soto (2016) stated that Scrum was a framework for product development. The different processes and techniques could be applied to complex projects.

According to Lee (2012), Scrum is an innovative approach to get work done. It is an agile framework for completing complex projects. Scrum originally is formalized for software development projects, but it works well for any complex work. The possibilities are endless.

In Scrum, there are three roles involved. Those are product owner, Scrum master, and Scrum team (Permana, 2015). Product owner will choose the Scrum master and Scrum team in project development. Then, product owner creates a priority list of features to be developed. Scrum master is in charge of helping Scrum team to understand the

features developed. Then, scrum team develops the product based on the given requirements by the product owner. Based on the explanation, this research aims to identify, analyze, and design a procurement information system using scrum developed by an IT consultant company for their client companies

II. METHODS

The research design is a qualitative method. First, literature study is conducted by searching the references from books, articles, journals, and websites related to the topics from Google. The keywords are system development, Scrum method, e-procurement. Second, in the field study, the researchers conduct interviews with related parties such as project manager, developer, and Quality Assurance (QA) to obtain the required information. Third, for document study, the researchers learn from the functional specification document, technical specification document, and user manual of the previous system and the developed system being. The researchers also read the information on the company website.

Fourth, the researchers learn and try e-procurement of existed and developed system from web applications and databases. Fifth, in the analysis researchers analyze the problems related to the procurement process at the client company in the IT consultant. Then, the researchers examine the requirements of the system using object-oriented analysis with Unified Modeling Language (UML) as tools. Sixth, in design method, the researchers design the web-based e-procurement system to support the procurement process at the client company in the IT consultant. Moreover, the researchers design the system using object-oriented design. It is done by changing the generated conceptual model in the analysis phase. The research framework is in Figure 1.

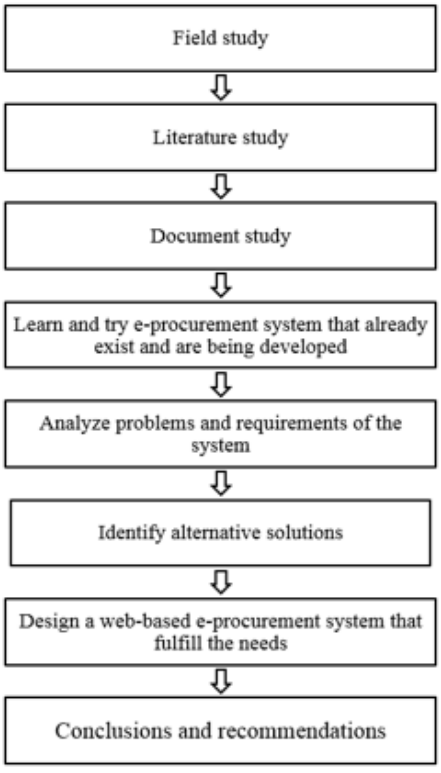

Figure 1 Research Framework

III. RESULTS AND DISCUSSIONS

Based on the observation and user requirements, there are several problems faced by the existing e-procurement system. First, the e-procurement system has no integration with the inventory system. The activities such as stock checking and stock addition are done manually. Second, the vendor searches and registration process is done manually. Vendors have to contact the purchasing department if they want to submit quotation for the Request for Quotation (RFQ). Third, input price of goods in RUF can only be fixed number. Meanwhile, the price of goods from each vendor may vary.

Based on the problem analysis, the development of e-procurement system can be proposed. E-procurement system is integrated with the inventory system, so it will update goods data in the inventory system when creating and editing the item. Then, it will add stock in inventory when Receive Report (RR) document is made automatically. Vendor search and registration process can be done automatically. The vendors can register themselves in the system. They will be notified if there is a new RFQ document. Then, they can create a quotation document. There should be a new feature for RUF documents. It can accommodate the input of price in the range of numbers. Thus, it can be more flexible and effective in finding the right vendor.

As the part of the scrum implementation, the company conducts daily meetings for about 15 minutes to report the project progress. Scrum master will open a web-based project management application called Trello (https://trello.com). Every week, the Scrum master will create a card containing a checklist that should be done in that week's sprint (one sprint consists of four weeks). Every day, the card will be reviewed. If the item in the checklist is completed, it will be checked. If there is additional feedback, a new checklist item will be made.

Figure 2 Example of Feedback Checklist in Trello

In Figure 2, feedback and bugs in the system are reported. Once it is done, the checklist item will be checked at the next daily meeting. It will continue until all the items in the checklist are done. The examples of the completed list can be seen in Figure 3.

Every week, the scrum master must make a weekly progress report to the project owner. Project progress is reported in the format of: 'Done', 'To do', and 'Issue'. Done list contains the tasks that have been done. To do list are

the tasks that have not been done and will be done in the next week. Issue list is the obstacles encountered during that week. A sample of a weekly progress report on Trello can be seen in Figure 4.

Figure 3 The Completed Feedback Checklist on Trello

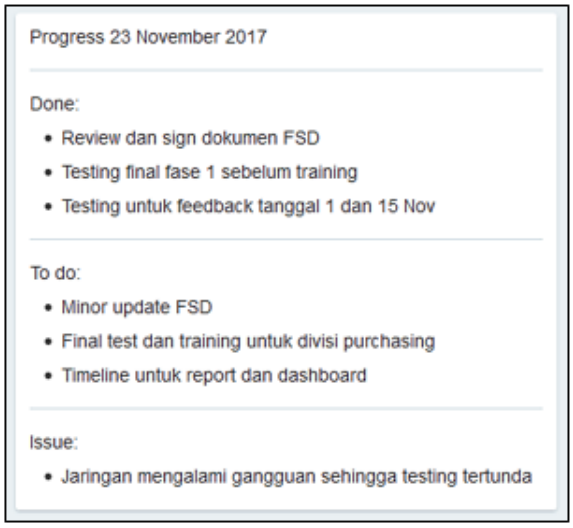

Figure 4 Example of Weekly Progress Report on Trello

The adoption of Trello in Scrum implementation are improving the team to identify the problem and solve it in a week. The researchers conclude that the future Scrum implementation must use web-based project management application for recording the action plan (Bass, Pejcinovic, & Grant, 2016)

Figure 5 shows the use case diagram of the e-procurement system. The figure represents what each user can do in the system. There are five roles. Those are admin, requestor, Stock Control Management (SCM), purchasing, and vendor. The system features for the requestor are create RUF, delete RUF, edit RUF, login, logout, create receipt report, submit receipt report, submit request usage form, add item to RUF, and remove item from RUF. The system features for vendor are login, logout, and create quotation.

Moreover, the system features for SCM are login, logout, create receipt report, submit receipt report, create Purchase Request (PR), edit PR, submit PR, and Purchase Request Summary (PRS) quantity revision. Then, the system features for admin are login, logout, create master data, edit master data, delete master data, and change master data status. The system feature for purchasing are login, logout, create RR, submit RR, create quotation, create Purchase Order (PO), edit PO, create RFQ, start RFQ, finalize for quotation, create PRS, submit PRS, create Winner Selection (WS), edit WS, and submit WS.

The critical success factor of this system development already complies with the findings from Suryani (2011) from the project preparation, organization change, and inclusion of the vendor in the system. The teams agree that the system development applies scrum method and the system features from user requirement. It is already discussed between project manager, developer, and QA. In the creating RUF, the user can approve or reject the request. This feature is very important for automating the authorization process.

Figure 6 to Figure 9 show the user interface of the e-procurement system. These figures do not represent all the interfaces in the system. Only important parts of the interface are chosen. Pages like create, edit, and detail are shown once to represent the others because the outline is quite similar.

Figure 6 shows the RUF page. The RUF page can be accessed via the RUF menu. On this page, the list of all the RUFs in the system is displayed. The displayed RUF information is RUF code, annotation, status, created date. The user can select one of the RUF code to view the RUF detail. The user can press the Tambah (add) RUF button at the bottom of the page to create a new RUF. The user can press the pencil icon in the action column to edit one of the RUF. Moreover, the user can choose the trash can icon in the Action column to delete a RUF. Then, a confirmation lightbox will appear.

Figure 7 shows the create RUF page. The create RUF page will appear if the user presses the Tambah (add) RUF button on the RUF page. On this page, the user can add a new RUF by filling in the several fields. Those are item category, company name, item type, budget, required date, destination address, and description.

The mandatory fields in the create RUF page are item category, company name, item type, required date, destination address, and description. If the user does not provide the mandatory information, the system will not create the RUF.

Figure 8 shows the RUF detail page. The RUFdetail page will appear if the user selects one of the RUF code on the RUF list page. In this page, the user can see the details of RUF such as RUF creator, RUF code, created date, required date, item type, item category, department, company name, destination address, RUF status, description, list of items in the RUF, and RUF approval history. Then, the user can edit the RUF by pressing the edit button. The user can also add items to the RUF by pressing the Tambah (add) item button. The user can apply for RUF approval by pressing Ajukan Persetujuan (apply for approval) RUF button. The system will send RUF data to the e-approval system.

In Figure 9, it shows RUF edit page. The page will appear if the user presses the Edit button on the RUF Form page. In this page, the user can modify RUF data in the form such as item type, date required, budget, destination address, and description.

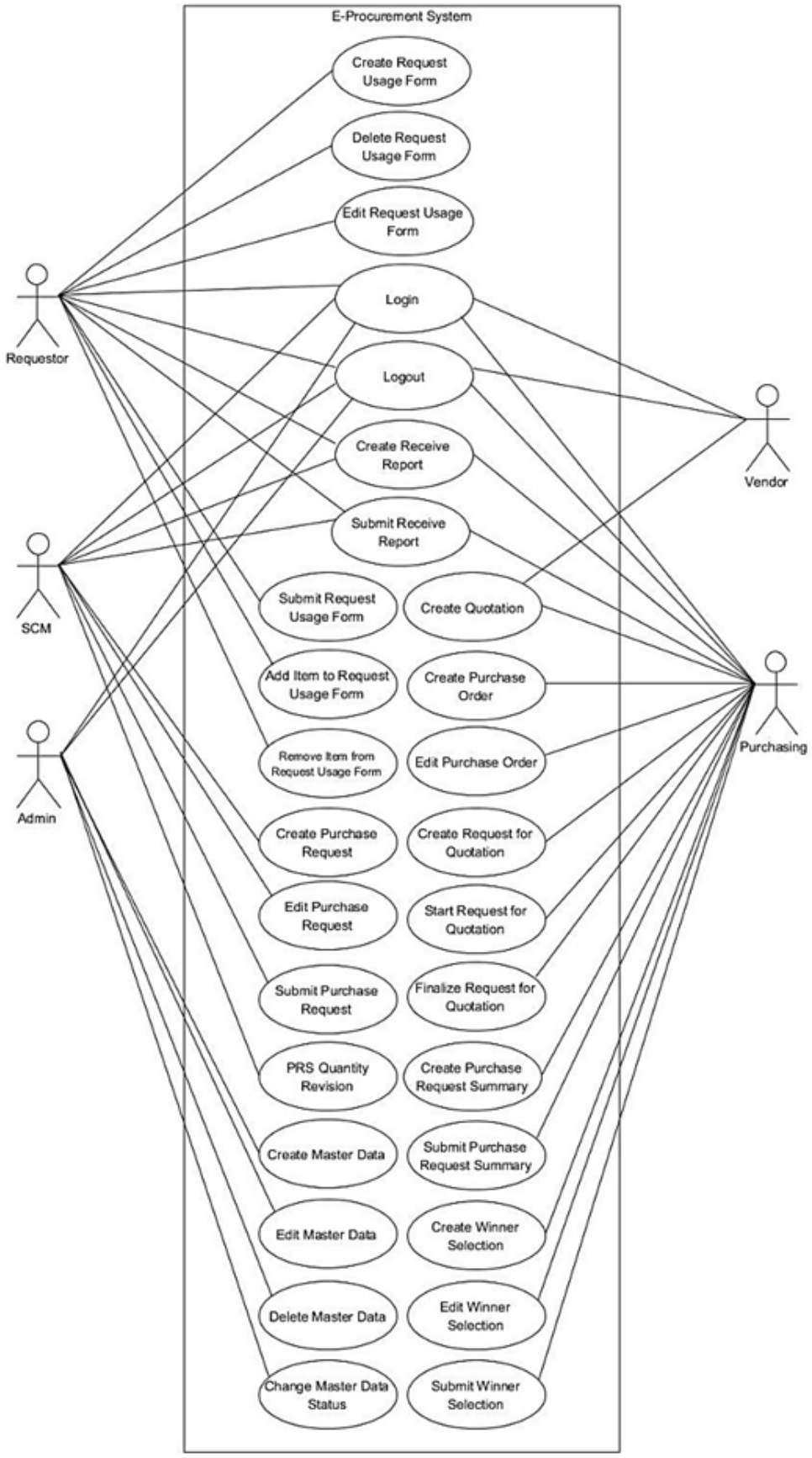

Figure 5 Use Case Diagram of the E-Procurement System

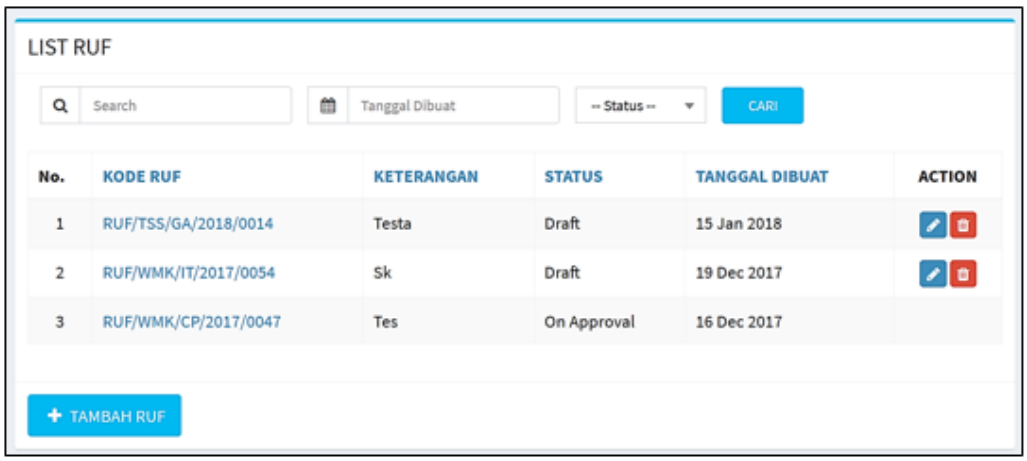

Figure 6 RUF List Page

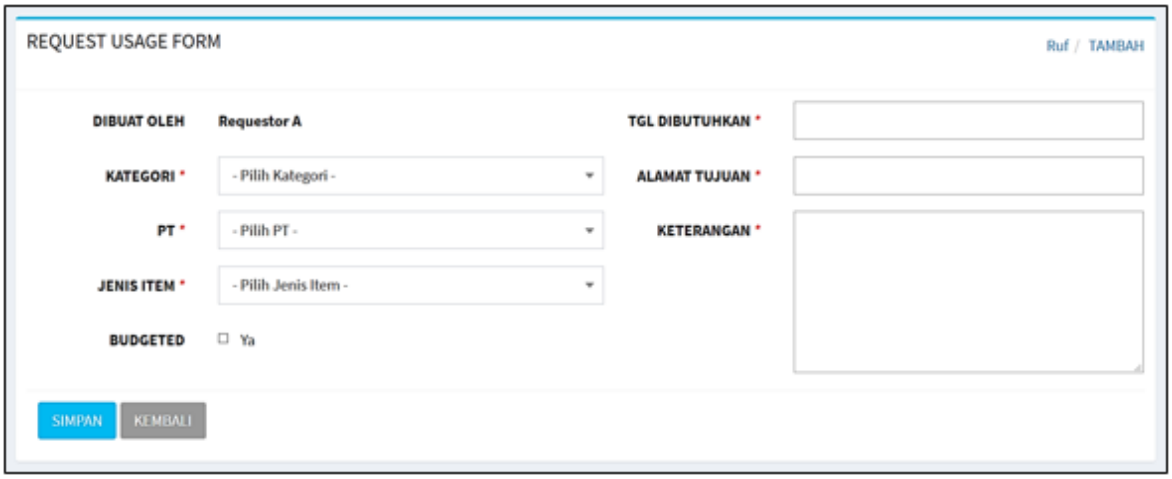

Figure 7 Create RUF Page

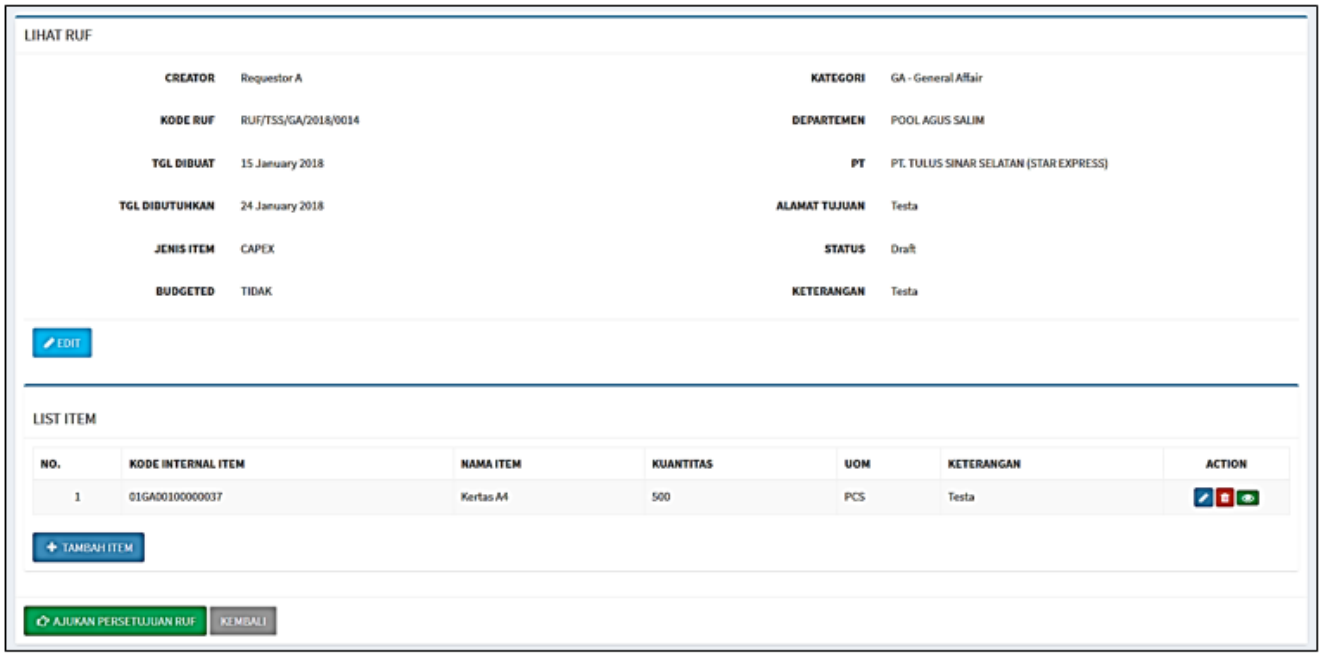

Figure 8 RUF Detail Page

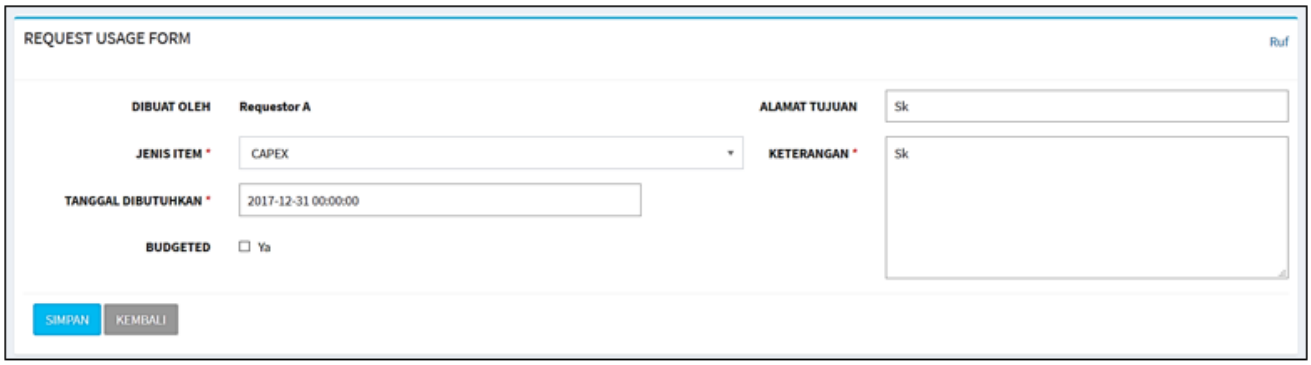

Figure 9 Request Usage Form Edit Page

IV. CONCLUSIONS

After analysis and design of the e-procurement system, there are three conclusions. First, the developed e-procurement system is a web-based application. It has several system features to support the procurement process of goods in the company, namely RUF, PR, PRS, RFQ, quotation, WS, PO, and RR. Second, the e-procurement system can simplify the overall procurement process, increase transparency and security, and save administration costs by reducing the cost of paper usage. In addition, with the procurement process in the system, the potential human error can be reduced significantly. Third, the e-procurement system is integrated with approval system and inventory system. Thus, it can reduce the amount of work required and shorten the procurement process time. Fourth, the e-procurement system can facilitate vendors in the procurement process. It is because each vendor has their account in the system and can create quotation document as a response to company's RFQ.

Moreover, there are three suggestions to improve the future development of the e-procurement systems. First, the company can create a standardized table naming, attributes, and variables. Second, it should create manual documents for the user to help to understand the system. There are some confusing menus in the system. Third, it can create dashboard feature that will appear on the homepage when the user logs into the system. In the dashboard, it can display the important information for the specific user. For example, for the SCM user, the dashboard will display how many purchase requests that have been created, approved, and rejected in the last month.

The limitation of this research is that the researchers are intern in the IT consultant company. Therefore, the user requirements are provided by the team. Then, the researchers only state one example of scrum meeting in solving one case. The researchers only discuss the request usage, WS, PO, and goods receipt.

The future research should create a case study on the scrum method in system development and evaluate the implementation of the e-procurement. The case study of the scrum method in system development is very important to be discussed. This method is widely used in some IT consultant company nowadays.

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