E-Procurement Process Reengineering for Prohibiting The Corruption Initiatives by Proposing a Real-Time and Integrated Bidding Solution

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Abstract

The electronic procurement (E-Procurement) system in Indonesia faces several critical problems such as low process efficiency, insufficient transparency, and a high potential for procurement corruption and fraud. This study aims to design improvement of Indonesia's E-Procurement system that can minimize corruption and improve efficiency in the procurement process by using Business Process Reengineering (BPR) and Structured System Development (SSD) methods. BPR is performed by modeling and simulating current (As-Is) and proposed (To-Be) process. SSD in this study consists of four stages; the creation of Entity Relationship Diagram (ERD), relational tables, use case diagram, and Data Flow Diagram (DFD). This study provides three improvement scenarios to solve issues in the E-procurement system by implementing an integrated information system linkage across government agencies and a real-time bidding solution. The three scenario models' simulation has different solutions to minimize corruption and produce different cycle times for each scenario. Using the SSD method, the information system model is designed to support business process improvement with the best scenario.

Keywords
Business Process Reengineering, Corruption, E-Procurement, Information System, Structured System Development

1. Introduction

Corruption has become a significant problem globally, which causes stunted economic growth, distorted investment, and low quality of public services. Public procurement is one of the government sectors most vulnerable to corruption. In addition to the volume of transactions and financial interests at stake, corruption risks worsen by the complexity of the process, the close interaction between public officials and businesses, and many stakeholders (Organization for Economic Cooperation and Development, 2016). In Indonesia, public procurement is a high-risk sector that is consistently being in the top three cases handled by the Corruption Eradication Commission every year (Komisi Pemberantasan Korupsi, 2018).

E-Procurement is a system to support the procurement of goods and services by utilizing internet-based information technology. The entire transaction process can be carried out electronically without the need for face-to-face meetings between the procurement committee and participants (Komakech, 2018). The use of E-Procurement is considering as one of the ways to prevent corruption and fraud in the procurement sector. Indonesia has implemented an E-Procurement system in its public procurement processes. Even though it has been done electronically, however, there are still a lot of gaps to commit deviations in the procurement sector. One of the reasons is the process of evaluating procurement documents and the determination of tender winners, which is still done manually. A face-to-face meeting between the procurement committee and tender participants is still taking place. One example is the process of proving qualifications. In fact, ideally, every transaction can be done through an electronically digitized system (LKPP, 2018). Besides, the limited availability of the procurement database and supporting system infrastructure also becomes an obstacle to the electronic procurement process, the efficiency of E-Procurement is also still very low.

This study will analyze the current (As-Is) E-Procurement business process model as a basis for designing business process improvement models (To-Be) and information systems that can minimize corruption and increase efficiency in the procurement process. Data is collected through analysis and review of procurement regulations and reports in Indonesia, observation of E-procurement application system version 4.3, interviews, and focus group discussions with National Public Procurement Agency as known as LKPP and Corruption Eradication Commission as known as KPK. This study's data processing and improvement design was done using Business Process Reengineering (BPR) and Structured System Development (SSD) methods. BPR is a business management strategy that focuses on analyzing and designing material and information workflows and processes within an organization (Hammer & Champy, 1993). BPR recommends that the old process system should be removed and replaced with a new system that is more innovative and effective (Dachyar & Christy, 2014). SSD is a method used to analyze and design the flow of the information system (Masayu & Dachyar, 2018). SSD techniques consist of logical data modeling, entity behavior modeling, and data flow modeling (Ashworth & Slater, 1993). The selection of object and methods used in this study is based on the lack amount of research that discusses the prevention of corruption in Indonesia's E-procurement system. There is also no research that focuses on improving business processes and information flow of E-procurement system in Indonesia. This study's novelty is the combination usage of BPR and SSD methods that focus on improving the E-Procurement business process model as an initiative to prevent corruption. This study applies an integrated and real-time E-Procurement information system and bidding solution.

2. Methodology

This study's initial stages began by observing and doing in-depth interviews with experts to map the current (As-Is) business processes of the E-Procurement model. The As-Is business process model is modeled with Business Process Modeling Notation (BPMN) and simulated using iGrafx software. The result of the simulation was analyzed to see the problems. Interviews and focus group discussions with experts were conducted to identify existing issues and needs of the E-Procurement system. The existing problems are combined with conditions identification as the basis to produce solution recommendations. Solution recommendations were classified and designed into several To-Be model scenarios. The best scenario will be chosen by comparing the As-Is business process model with each To-Be model scenarios. The best scenario will be implemented as an improvement in the E-Procurement system. Furthermore, using the SSD method, the information system model is designed to support the E-Procurement business process improvement. After the data is processed and analyzed, the research conclusions are generated. See Figure 1.
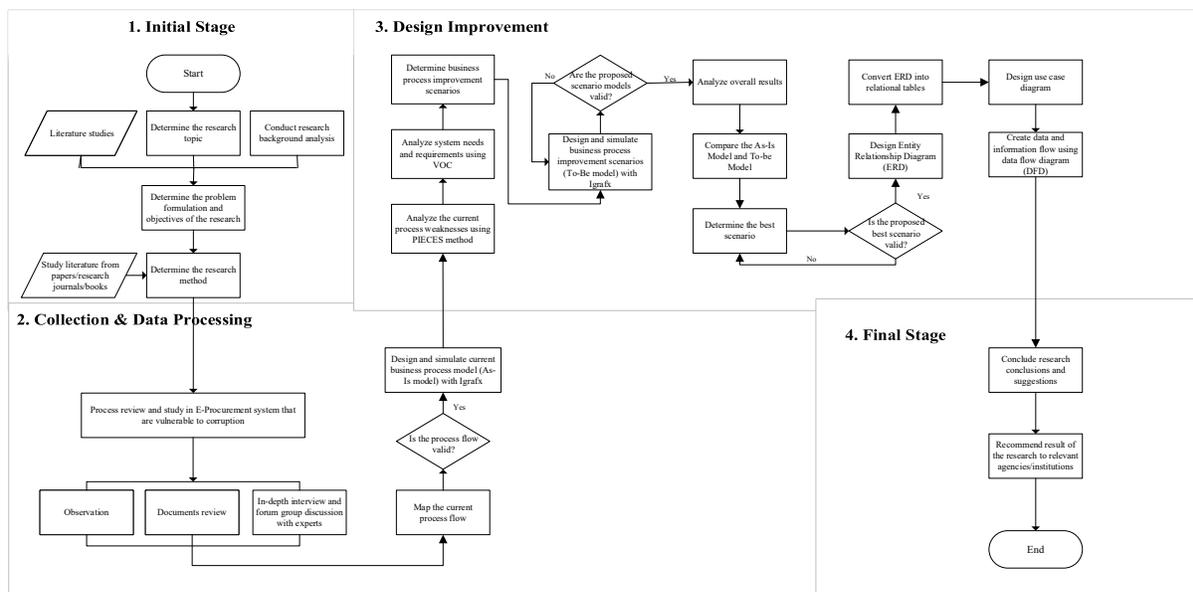

Figure 1. Methodology process flow

3. Result and Discussion

E-Procurement is a public procurement system that uses internet-based information and communication technology in its processes. The purpose of E-Procurement is to increase efficiency, transparency, and accountability, increase fair business competition, increase market access, and support the ease of monitoring and auditing processes (Siahaya, 2016)

Interviews with experts and observations, including measure each process time, were conducted to map the existing process (As-Is process) of the E-Procurement system. Furthermore, problems and the needs of the system are being analyzed based on the results of data collection and in-depth interviews with LKPP and KPK. Business process improvement (To-Be process) scenarios use analysis results as a basis for generating improvement. The information system model with the SSD method consists of four stages; Entity-Relationship Diagram (ERD), relational tables, use case diagram, and Data Flow Diagram (DFD) design to support E-Procurement business process improvement.

3.1 Current E-Procurement System Process (As-Is Model)

Observation, in-depth interviews, and focus group discussions with experts were conducted to generate the details of E-Procurement's current processing time and sequence. The As-Is process has four swimlanes based on the E-Procurement process actors, which are procurement officer, procurement work unit, bid evaluation committee, and tender participants. The procurement officer has a role in designing tenders and tender contract documents. The procurement work unit has a role in consolidating delicate packages and selecting the Bid Evaluation Committee. The bid evaluation committee is responsible for evaluating, responding to refutation, and determine the tender winner. The tender participant has a role in enrolling in the procurement process. In total, the As-Is model consists of 37 processes. The As-Is Model is designed with BPMN can be seen in Figure 2.

The simulation results of the As-Is model can be seen in Table 1. There are three types of time in the simulation results; average cycle, average work, and average wait. Average cycle is the time for a process to take place in a simulation. This term is also known as lead time which consists of the sum of average work time and average wait time. Average work time is the amount of time required when a process is actively in progress, while average wait time is the time for each process to wait for its turn to start. The processes with zero value of average wait time indicate that the process is efficient in terms of time because there are no waiting and delay in its simulation.

Table 1. E-Procurement As-Is model simulation result

	Transaction (Days)		
	Avg. Cycle	*Avg. Work*	*Avg. Wait*
E-Procurement Simulation Result	17,45	6,32	11,13
Swimlanes (Unit)	**Detail Transactions per-Lane (Days)**		
	Avg. Cycle	*Avg.Work*	*Avg. Wait*
Procurement work unit	0.01	0.01	0.00
Tender participants	3.04	1.79	1.25
Bid evaluation committee	14.10	4.22	9.88
Procurement officer	0.29	0.29	0.00
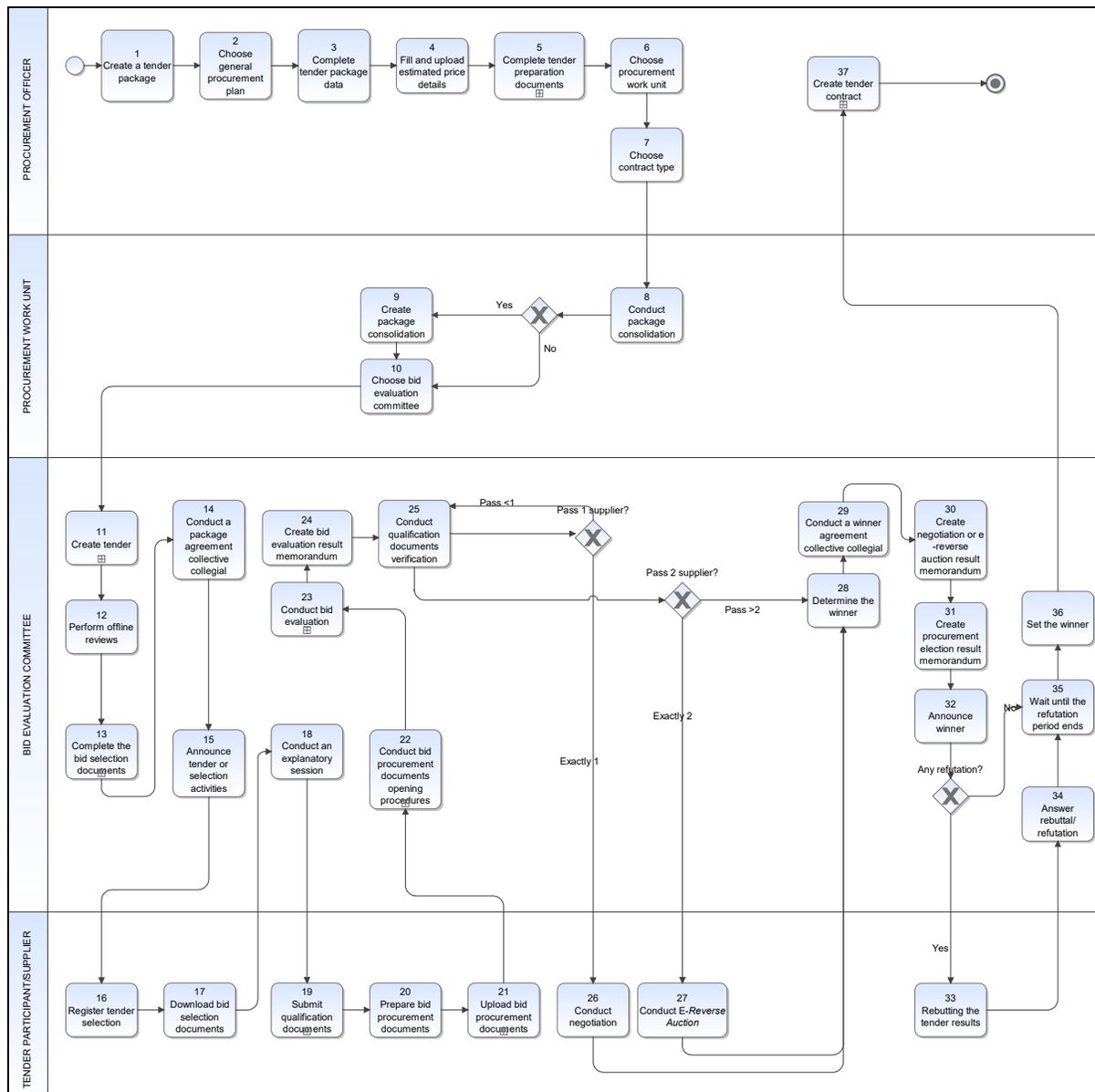
Figure 2. E-Procurement system as-is model

3.2 Designing Solutions

The problem identification of E-Procurement is obtained based on the results of the As-Is model business process simulation, in-depth-interviews, and focus group discussions with experts. After the existing problems are determined, the identification of system needs and requirements is carried out using the VOC method (see Table 2). VOC is divided into two types, that is the context of Data and Process. VOC in the context of data consists of the needs and requirements of all records, reports, and information related to the E-Procurement system, shown in Table 3.

Table 2. VOC of E-Procurement data

VOC in the Context of Data		
Context	*Drivers Variable*	*Source*
Data accuracy refers to the quality of data in providing correct information according to the actual situation and value.	Accuracy	(Caniato et al., 2014; Country Portfolio Performance Review, 2012; OECD, 2016; OECD & Public Governance Committee Finland, 2019; Patrucco et al., 2016)
The complete availability of all data, that related to the entire procurement process.	Completeness	(Darr, 2019; Kiage, 2013; OECD, 2018a; US General Services Administration, 2017)
Data is presented in real-time or in the actual time during which a process or event occurs.	Timeliness	(Lentz et al., 2013; OECD, 2018a; Popa, 2017; Schill, 2010; Vaidyanathan & Devaraj, 2018)
Data combination from different sources into one single window, that can facilitate data access between related authorities.	Integration	(Becker, 2018; Eriksson & Sjodin, 2010; Mynarz, 2014; OECD, 2018a; Phillips et al., 2015; The World Bank, 2016)

VOC in the context of the process consists of the needs and requirements of E-Procurement processes carried out by the government to purchase goods, services, and work construction.

Table 3. VOC of E-Procurement process

VOC in the Context of Process		
Context	*Drivers Variable*	*Source*
The procurement process uses non-excessive funds and resources to achieve the targets within a specified time.	Efficient	(OECD, 2018a; The World Bank, 2016, 2017)
The procurement process must be in accordance with the needs and targets that have been set and provide maximum benefits.	Effective	(Caniato et al., 2014; OECD, 2018a; The World Bank, 2016)
All provisions and information regarding procurement can be widely known by business actors and the general public.	Transparent	(Assessment, 2007; OECD, 2018a; The World Bank, 2016)
The procurement process is carried out by following rules and regulations and can be justified.	Accountable	(OECD, 2018a, 2018b; The World Bank, 2016)

The solution recommendations were built based on the results of the current process analysis, problem identification, and system needs and requirements, as shown in Table 4.

Table 4. E-Procurement goals-problems-solutions

Goal	Problem	Solution	Classification
Process efficiency, data completeness, data accuracy, integration, accountability	Goods/Services specifications directed specifically to certain suppliers.	Database system of standardized prices and specifications of goods/ services	Integration, Integral Technology
	Price mark-up		
	Interventions and errors in determining the prices and specifications of goods/ services		
Process effectiveness, data completeness	Re-participation of precarious suppliers with poor track record, involved in corruption, etc.	Historical data and digital records checking automation with the implementation of Vendor Management System.	Integral Technology

Goal	Problem	Solution	Classification
Data completeness, data accuracy, data timeliness, process efficiency	Manipulation of administrative documents	Procurement ecosystem optimization by integrating databases between government agencies, to facilitate the process of evaluating administrative documents and eliminating the process of qualification verification.	Integration, Integral Technology, Task Elimination
	The process of administrative documents evaluation is still done manually and requires a long time.		
	The process of qualification documents verification is still done manually, which requires tender participants to come to the government office.		
Data timeliness, process efficiency, transparency	The process of bidding evaluation takes a long time.	Real-time bidding by entering bid prices online and real-time simultaneously at a specified time.	Integral Technology

3.3 Proposed E-Procurement Process Improvement (To-Be Model)

Solution recommendations to improve E-Procurement business process flow are classified into two major classifications based on the approaches taken in this study that can be seen in Table 5.

Table 5. Solution recommendations

Solutions	Classification
Online and real-time prices were bidding.	BPR Best Practice Approach
The database system of standardized prices and specifications of goods/ services	Information System Improvement Approach
Implementation of Vendor Management System (VMS)	
Digital integration across government agencies by using a relational database	

Solution recommendations will be modeled into the E-Procurement To-Be model scenario, which is divided into three scenarios, as shown in Table 6. The three scenarios are designed based on the classification of solutions that are capable (Table 5) to achieve goals and solve problems in the E-Procurement system. The three scenarios were also created based on the urgency of E-Procurement processes that have to be improved immediately and the LKPP condition so that the scenarios proposed is feasible to be carried out.

Table 6. Improvement scenarios

Scenario	Improvement Strategy	
	BPR Best Practice Approach	*Information System Improvement Approach*
1st To-Be Scenario	V	
2nd To-Be Scenario		V
3rd To-Be Scenario	V	V

The 1st scenario is based on the BPR best practice approach. This scenario is executed by implementing online and real-time prices bidding simultaneously by tender participants. Real-time bidding will eliminate the process of uploading and evaluating bid price documents. The adoption of this scenario also affects the evaluation system which will be turned into two-envelope-systems. Two-envelope systems mean that the contracting entity must evaluate the tender offer based on qualitative criteria without knowing the price in an individual tender (Olsen, 2019). The implementation of the 1st scenario will maximize the value-for-money of the public procurement process by choosing the best combination of quality and price.

The 2nd scenario recommends the improvement of relational database usage in the public procurement process, which is divided into three types, which are the creation of standardized prices and specifications of goods/services

database, vendor management systems, and digital integration between E-Procurement system with government agencies. Scenario 2 is considered capable of creating a more optimal procurement ecosystem, increase efficiency, and decrease costs of the procurement process. This scenario also eliminates the process of proving qualifications that were previously carried out offline, because tender participants are no longer need to go to the office of the government offices to show the authenticity of their administrative documents and qualifications. The documents will be verified online using the integrated database. The database owned by government agencies that will be integrated with e-procurement systems consists of a Trading Business License and Company Registration Certificate that is owned by the Ministry of Trade. Single Business Number owned by Investment Coordinating Board Committee, Tax Identification Number, and Annual Tax Return owned by Tax Directorate General and National Identity Card owned by Population and Civil Registration Agency. The implementation of the 2nd scenario is able to eliminate corruption in the form of directed price and specifications to certain participants, price mark-ups, re-participation of precarious vendors, manipulation of administrative documents, and collusion.

The 3rd scenario is performed by combining the 1st scenario and the 2nd scenario. The implementation of the 3rd scenario will result in a more optimal ecosystem, increase efficiency, reduce time, and maximize the value-for-money of public procurement. The implementation of the 3rd scenario will provide an efficiency level of 40% which is higher than the 1st scenario which is only 16% and the 2nd scenario which is 34%. Scenario 3 also provides the largest waiting time reduction from 11.13 days to 6.7 days. The implementation of the 3rd scenario which combines real-time bidding and relational database improvement is expected to be able to ensure objectivity in making tender winner decisions because it reduces the risk of biased technical evaluation, in which price considerations are prioritized over quality. So, it maximizes value-for-money in the public procurement process by choosing the best combination of quality and price. This scenario is also able to eliminate more gaps in corruption practices, goods/services specifications directed specifically to certain suppliers, price mark-ups, interventions, and errors in determining the goods/services prices and specifications, re-participation of a precarious supplier, documents manipulation, and collusion.

The simulation results from each proposed To-Be model scenario are compared with the As-Is model result as shown in Table 7.

Table 7. To-Be Model scenario result comparison

Scenario	Avg.Cycle Time (in Days)	Time Reduction (%)	Avg.Waiting Time (in Days)	Time Reduction (%)
As-Is	17,45	-	11,13	-
1st To-Be	14,62	16%	8,63	22%
2nd To-Be	11,43	34%	7,05	37%
3rd To-Be	10,48	40%	6,70	40%

The results from the simulation of three scenarios show a reduction in average cycle time and waiting time. Average cycle time is the total time from the beginning to the end of the simulation which consists of the total amount of average working time and waiting time. Thus, the relationship between average cycle time is directly proportional to average working time and average waiting time. So that the decrease in the average cycle time will affect in reducing the average waiting time in the process simulation. Based on data shown in Table 7, the 3rd To-Be scenario provides the greatest reduction of cycle time, which is 40% compared to the As-Is model. The 3rd scenario also managed to cut the waiting time from 11.13 days to 6.70 days. The 3rd scenario combines the 1st and 2nd To-Be scenario with the implementation of online and real-time prices bidding, database system of standardized prices and specifications of goods/ services, vendor management system, and digital integration across government agencies by using a relational database. All business process changes and modifications in the 3rd scenario can be seen in Figure 3, where the modified process is marked in yellow, and the eliminated process is marked in red.
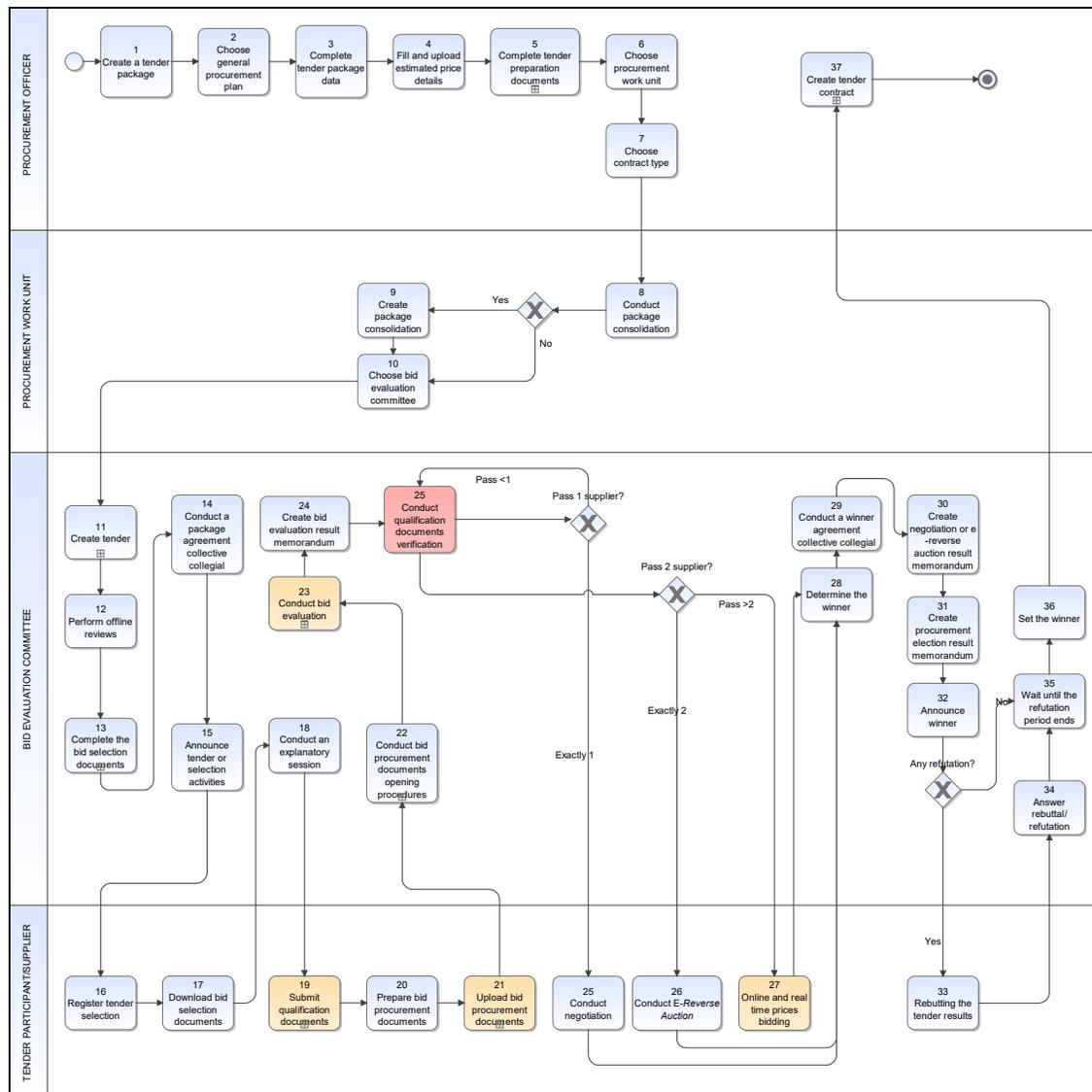
Figure 3. E-Procurement system 3rd (to-be) scenario

3.4 Designing Information System Improvement

The design of information system improvement uses SSD method, which consists of four stages; Entity-Relationship Diagram (ERD), relational tables, use case diagram, and Data Flow Diagram (DFD). The design of E-Procurement information system improvement adopts the 3rd scenario, which is a complete scenario model with the best process efficiency result.

The conceptual design of the E-Procurement information system is illustrated using an ERD. ERD functions to design the structure and relationship of each data in the E-Procurement process. ERD of E-Procurement process improvement consists of 9 strong and 9 weak entities. Entities that are classified as strong entities are, Tender_Participants, Procurement_Officer, Bid_Evaluation_Committee, Tender_Activities, Government_Internal_Supervisory, Ministry_Of_Trade, Population_Civil_Registration_Agency, Tax_Directorate_General, and Investment_Coordinating_Board_Committee. Meanwhile, the weak entities are Vendor_Management_System, Goods_Services_Specifications, Procurement_Document, National_Identity_Card, Company_Registration_Certificate, Trading_Business_License, Single_Business_Number, Tax_Identification_Number, and Annual_Tax_Return_List. Every entity has a relationship with another entity.

Conceptual designs that have been designed using ERD are then converted into logical design by using relational tables. The relational tables function to illustrate relationships between entities in a database as well as ERD, but in a form that is simpler and easier to understand. The relational tables can be seen in Figure 4.
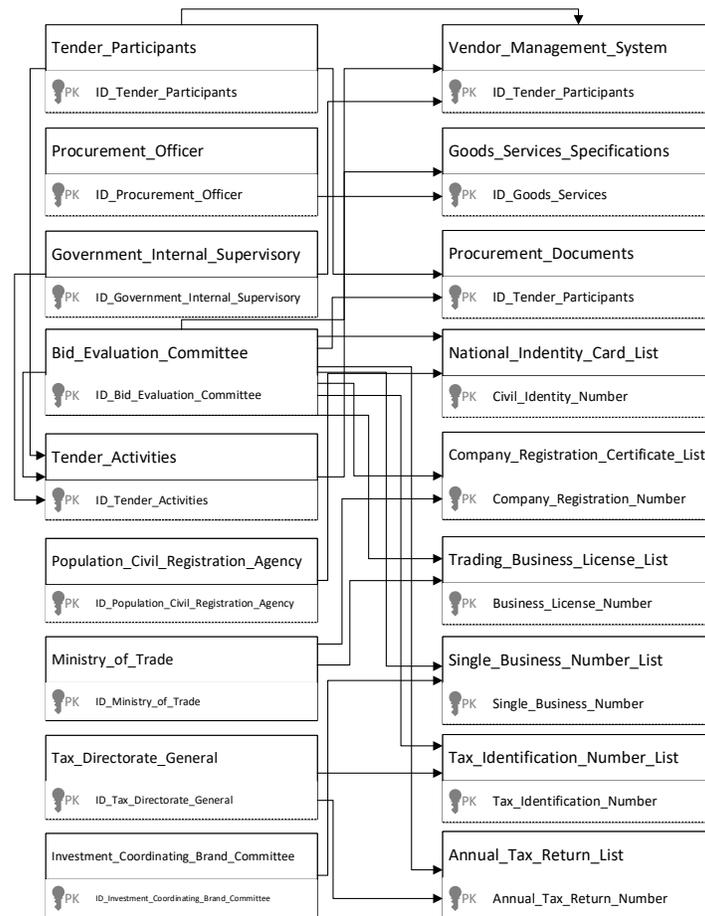
Figure 4. E-Procurement system improvement relational tables

The third stage of SSD is performed by using a use case diagram. Use case diagram is useful to identify the actors who interact with the system. The first step in making use case diagrams is to identify each actor in the system and their respective roles. There are 11 actors of E-Procurement process improvement, that are user, bid evaluation committee, procurement officer, supplier/tender participants, government internal supervisory, E-Procurement user interface, vendor management system user interface, ministry of trade, population, and civil registration agency, investment coordinating board committee, and tax directorate-general.

The fourth stage of SSD is generated by applying DFD. DFD function is to illustrate a visual form that explains the flow of data and information in E-Procurement system improvement. DFD states the source and the destination of information. DFD also describes to where or whom the information is needed to be stored or accessed. DFD of E-Procurement system improvement consists of a context diagram, as shown in Figure 5. The context diagram illustrates the main information flow and external entities in the E-Procurement system. Then, the context diagram will be decomposed in more detail way into DFD level 0 that can be seen in Figure 6.
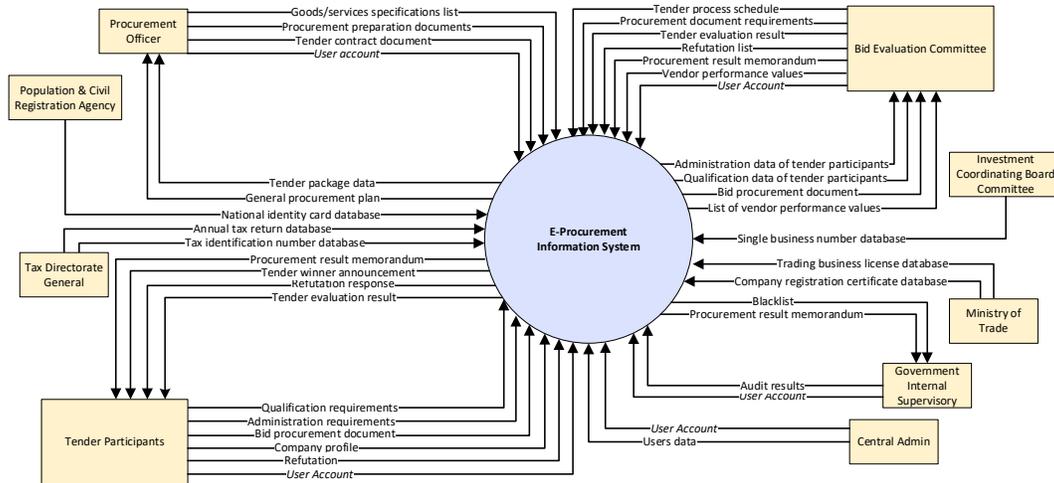
Figure 5. E-Procurement system improvement context diagram
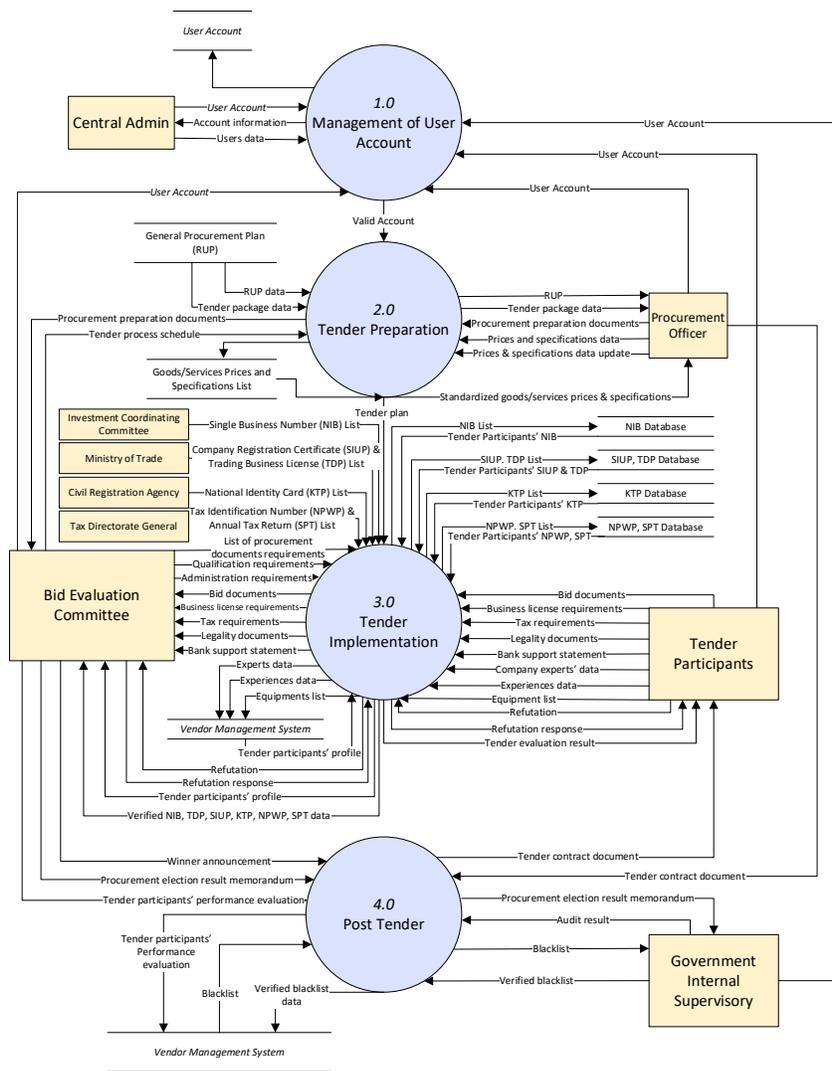
Figure 6. E-Procurement system improvement DFD level 0

4. Conclusion

This research has successfully redesigned the E-Procurement business processes and information system that was previously not yet fully digitalized and still has a lot of gaps in corruption practices into a system that is more digitalized, efficient, and more corruption-free by applying real-time bidding and integrated information system by using relational database across government agencies.

The proposed E-Procurement model improvements are divided into 3 To-be scenarios. The best scenario to be implemented is the 3rd scenario, which is designed by combining the BPR best practice approach and information system improvement approach.

Suggestions for further research is to conduct a Risk Management related to find out possible risks that may occur, how to prevent these risks from happening, and how to overcome these risks if they occur in the E-Procurement process.

Acknowledgements

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