Reengineering the Distribution System of Technical Document in Company X Using BPR Best Practices

Sriwulan Larasati, Cucuk Nur Rosyidi*, & Azizah Aisyati
Production System Laboratory
Industrial Engineering Department
Sebelas Maret University
Jalan Ir. Sutami 36 A. Surakarta, Indonesia
Email: *cucuk {at} uns.ac.id

***Abstract*— Company X is a manufacturing company that assembles four wheeled vehicles in Indonesia. The company uses technical document as an instruction tool for parts modification. The document is sent from the principal company abroad to Company X and will firstly receive by Engineering Division and flow through the other divisions in the company. The distribution of the technical document will be end in the suppliers which must be involved in the process since they must supply the parts to the company. A preliminary study has been conducted and the results showed that the actual lead time of technical document information flow is 51 days which longer than the ideal lead time (11 days) set by management. The root causes of the problem are there no common data which can be used by all divisions and lack of control over the administrative process. We recommend the company to build an integrated technical document control system so the technical document distribution process will be better and receive by suppliers on time. Based on the recommendation, it is necessary to shift the process from manual business process to integrated business process. The aim of this research is to propose an integrated distribution system of technical document in Company X using Business Process Reengineering (BPR) Best Practices. First, we mapped the existing business process of each divisions using flow diagram. Then we reengineer the business process using BPR Best Practices. Next, a simulation model is built based on the new business process to determine the distribution lead time. In the Final step, we evaluate the proposed business process using SWOT-AHP. Based on the simulation, it is found that the proposed business process can reduce the distribution lead time by 99.94%.**

Keywords- Business Process Reengineering, SWOT-AHP, technical document, distribution system, lead time, Best Practices.

I. INTRODUCTION

Company X is a manufacturing company which assembles and exports four-wheeled vehicles in Indonesia. In cars assembly process, the company is supported by many suppliers to provide car components. The company uses technical document as an instruction tool for parts modification.The document will flow from the principal company until suppliers. The technical document firstly sent by the principal company abroad and received by Engineering Division (ED) in Company X and then proceed to Production Control Division (PCD), Internal Plant, Purchasing Division (PuD) until finally received by the suppliers. Recently, some suppliers give feedback to the company about the lateness of technical document distribution. Its lateness has an impact to the suppliers since they must prepare the manufacturing process of components for new car. The lateness will affect the company in term of lose an opportunity to earn profit. We have conducted a preliminary research and found some factors as causes of the lateness of technical document distribution and provide recommendations for improvement [1].

In the preliminary research, we took 413 technical document samples and then we compared the ideal lead time with the actual lead time of technical document. The results of the research showed that the actual lead time of technical document is 51 days which is longer than the ideal lead time set by the management (11 days). Using Toyota Business Practices (TBP) method, we found two root causes of the problem. First, there are no common data which can be used by all divisions in the company. Second, lack of control over the administrative process. Based on the preliminary research, we recommend the company to build an integrated technical document control system so the technical document distribution process will be better and receive by suppliers on time. It is necessary to improve the business process of technical document distribution. The aim of this research is to reengineer the current business process of technical document distribution. The proposed business process will be used by the company to develop an integrated distribution system of technical document. In this paper, we use Business Process Reengineering (BPR) Best Practices. We also develop a simulation model to determine the distribution lead time under the proposed business process and employ SWOT-AHP to analyze the readiness of the company in its implementation.

II. LITERATURE STUDY

Business Process Reengineering (BPR) is a fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service, and speed [2]. BPR is redesign of business process and the associated system and organizational structures to achieve a dramatic improvement in business performances. BPR is not about downsizing, restructuring, re-organizing, automating the current process, or employing the new technology in the process. It is the examination and change of five basic business components: strategy, process, technology, organization, and culture [3]. According to Kumar et al. [4], the basic characteristics of BPR consist of: 1) View business as a set of customer-oriented processes rather than a set of departmental functions. 2) Processes must have clear cut ownership. 3) Non value adding activities within a process should be eliminated. 4) Gather information only once at the point of origin.

Over the last 20 years, best practices have been collected and applied in various areas, such as business planning, healthcare, manufacturing, and the software development process [4,5,6,7,8,9]. Best Practices mainly aims at BPR efforts, where an existing business process is taken as a basis for its redesign. A best practice can then be applied locally to boost the overall performance of the business processes. Reports on best practices are mainly derived from experience gained within large companies or by consultancy firms in BPR engagements. For example, the best practices as proposed by Peppard and Rowland in 1995 are derived from experiences of the Toyota Company [4,5]. Reijers and Mansar [5] have described 29 best practices and evaluated qualitatively their impact on the cost, quality, flexibility, and time criteria. Table 1 shows the 29 best practices and application examples [5]. For an example, Integration Best Practices is used by Baxter Healthcare to integrate their organization with their customer by just-in-time provision of hospital equipment.

Organizations which have become good in BPR implementation gained more market share, increased their profits, lowered the costs, and improved quality. They are able to deliver faster, and have greater flexibility. They are also blessed by happier and loyal customers. The future lies in moving from traditional practices to more analytical and result oriented approach. Table 2 shows some of the best practices for reengineering business process used by industries and its definitions [4]. For example Empower is a BPR best practice which gives workers most of the decision-making authority and reduce middle management.

Hall [10,11] claimed that 50-70 per cent of Business Process Reengineering (BPR) initiatives are failed to deliver the expected results. This is because, although there is an improvement in a particular area, at the same time business-unit cost will increase and decline the profits. Before BPR implementation, the organization's purposes and goals must be defined and the organization must carefully examines the external and internal environment to identify opportunities and constraints regarding the strategy as well as Business Process Reengineering [11]. Shareef et al. [12] integrated SWOT and AHP method to evaluate an e-Government system. We employ the SWOT-AHP method to analyze the readiness of the company to implement the proposed business process.The objective in utilizing the AHP within SWOT framework is to systematically qualify SWOT factors and equate their intensities [13]. The proposed method is applied in three steps [14]. First, list the considerable internal (strengths and weaknesses) and external (opportunities and threats) factors for the strategic planning to make up the SWOT analysis. Second, apply the pairwise comparisons to capture the weights of each SWOT groups. Third, use AHP to derive the relative priorities of each factor within the SWOT groups. In the last step, the overall weight rank is obtained by multiplying the local weight by the specific group weight for each factor [14].

AHP used Consistency Index (CI) and Consistency Ratio (CR) in verifying the consistency of expert's judgments [15]. If the CR of the matrix is too high, it implies that the judgments may be inconsistent and unreliable. In general, a CR between 0.10 and 0.20 is regarded to be acceptable. If the value is higher than 0.20, the judgments are unreliable and, therefore it has to be formulated again [16]. This procedure should be repeated until these values fall in the predefined range.

TABLE I. BEST PRACTICES AND APPLICATION EXAMPLES [5]

No.	Best Practices	Application Examples
1.	Control Relocation	Pasific Bell
2.	Contact Reduction	Ford's account payable departments reduces number of clerk's from 500 to 125 (from three points of contact to two).
3.	Integration	Individual (customers carry trays and clear away in fast foods) or a customer organization (Baxter Healthcare integrated their organization with their customer by just-in-time provision of hospital equipment)
4	None Order Types	IBM credit, three versions of the credit insurance process: performed by computer, by a deal structure, with support of specialist advisers.
5.	Task Elimination	Transportation, movement and motion (a high-tech company found out that its semi-conductors traveled 150000 miles during their transformation.
6.	Order-based work	Removal of batch processing and periodic activities when possible
7.	Triage	None
8.	Task Composition	An electronic company compressed responsibilities for the various steps or the order fulfillment process resulting in tasks combined into one task executed by a so called "customer service representative"
9.	Resequencing	Autonomated kiosks in Disney theme parks
10.	Parallelism	In a stylized business process. The end controls are parallelized
11.	Knock-out	None
12.	Exception	None
13.	Order assignment	Bell Atlantic assigned a case team to establish high-speed, digital circuits for business customers.
14.	Flexible-assignment	None
15.	Centralization	None
16.	Split responsibilities	None
17.	Customer teams	Microsoft (10000 employes) still works in teams of no more than 200 people despite

		information flowing problems
18.	Numerical Involvement	Who is needed for the handling of an insurance claim
19.	Case manager	Duke Power Company (public utility) where case managers present customers with the useful fiction of an integrated customer services process
20.	Extra resources	Example of a telephone operator company
21.	Specialist-Generalist	None
22.	Empower	IBM Credit, Specialist job as credit checker and pricer were combined into a single position "deal structurer"
23.	Control Addition	Taco Bell eliminated some supervisory layers to give more responsibility to restaurants managers leading to a new job category the Market manager
24.	Buffering	None
25.	Task Autonomation	Telephone-based businesses. Nissan uses a rule of thumb of not automating dirty, difficult or dangerous tasks
26.	Integral Business Process Technology	Shared databased, expert systems, telecommunication networks, etc
27.	Trusted Party	The creditworthiness of a customer
28.	Outsourcing	Taco Bell, the K- Minus System (Kitchenless restaurant)
29.	Interfacing	Interactive videodisk may be as good contact with a potential buyer as any personal contact

TABLE II. BPR BEST PRACTICES [4]

No.	Best Practices	Definition
1.	Task Elimination	Eliminate unnecessary tasks from a business process
2.	Task Composition	Combine small tasks into composite tasks and divide large tasks into workable smaller tasks.
3.	Integral Technology	Try to elevate physical constraints in a business process by applying new technology.
4	Empower	Give workers most of the decision-making authority and reduce middle management
5.	Order Assignment	Let workers perform as many steps as possible for single orders.
6.	Resequencing	Move tasks to more appropriate places
7.	Specialist-Generalist	Consider to make resources more specialized or more generalist
8.	Integration	Consider the integration with a business process of the customer or a supplier
9.	Parallelism	Consider whether tasks may be executed in parallel
10.	Numerical Involvement	Minimize the number of departments, groups and persons involved in a business process

III. RESEARCH METHODOLOGY

Flow diagram in Figure 1 explains overall steps to reengineer the current business process of technical document distribution in Company X. The methodology starts with data collection in all divisions of Company X. Business processes in processing the technical document in each division are mapped using flow diagram. The data are collected through observations and interviews. The respondents of the study comprise all of the employees including Department Head and Section Head who directly or indirectly involves in the distribution process. The authors conducted in-depth interviews with selected participants to examine the process to capture the existing business processes. The activities in the existing business process of technical document are classified into three types: value added process, non-value added process, and non value added but essential process. All processes that identified as non value added process and non value added but essential process are classified in category of waste. The existing business process is then reengineered using BPR Best Practices. We use Table 2 as a guide and conducted deep discussions with stakeholders to reengineer the current business process. After the new business process has been developed, we simulate the proposed business process to determine the distribution lead time. In the last step, we analyze the readiness of the company to implement the proposed business process using SWOT-AHP.

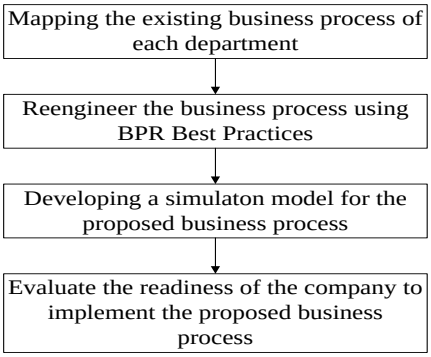

Figure 1: Research Methodology

IV. RESULTS

A. Mapping the Existing System

The existing system has been drawn in Appendix 1. From the existing system, we found the following inefficiency of the existing business processes:

- The arrival of the technical document from principal company is only known by Engineering Administration Department, Engineering Division.
- Data registration activities are conducted by each division when a technical document is received or sent to the next division.
- Data registration activities are conducted twice, using a software and internal system in each division.
- The next divisions can not handle the technical document if the previous division does not provide the signature of confirmation as physical evidence.

After maps the existing business process, we identify value added and non-value added process of the existing business process as suggested by [17, 18], and classify the non value added process in waste category as suggested by [19]. Table 3 shows the examples of identification and classification of the process. For example: The receiving of technical document by administration staff of EAD is identified as non value added but essential process, and it is classified in waiting category of waste. Based on the result of value added and non value added

identification, we have 3 value added processes and 61 non value added but essential processes.

TABLE III. IDENTIFICATION OF VALUE ADDED AND NON VALUE ADDED PROCESS AND CATEGORIES OF WASTE

No. Process	The existing business process	Value added	Non value added, but essential	Category of waste
P1	Admin of EAD receive package of technical document		✓	Waiting
P2	Admin of EAD download package of technical document		✓	Additional Process
P12	Admin of PED receive package of technical document from EAD		✓	Waiting
P16	Admin of EAD receive package of technical document		✓	Waiting
P17	Admin of EAD print Drawing (2D)		✓	Additional Process

B. Reengineer the Business Process using BPR Best Practices

The existing business process is then reengineered using BPR Best Practices. Table 4 shows some ways to reengineer the distribution business process using BPR Best Practices.

TABLE IV. SOME WAYS OF REENGINEER DISTRIBUTION SYSTEM BUSINESS PROCESS USING BPR BEST PRACTICES

No. process	The existing handling and distribution process	TE	TC	IT	R	SG
P1	Admin of EAD receive package of technical document			✓		
P2	Admin of EAD download package of technical document				✓	
P3	Admin of EAD document package of technical document in system and manually		✓	✓	✓	
P4	Admin of EAD print package of technical document	✓				
P5	Admin of EAD stamp "Received" package of technical document	✓				

Following the table, we determine the ways to reengineer the business process:

- **Task Elimination.** The improvement consists of elimination of the folllowing activities: print, stamp, dispatch note, acknowledgement report, documentation process by admin and PIC, inspection, receipt, and delivery processes. Those processes are not required because the processes will be replaced by an integrated system and will lead to a more efficient and faster process.
- **Task Composition.** The registration and documentation process in all divisions are combined into one task, which will conducted by Engineering Administration Department at Engineering Division. So, the documentation data can be used by all divisions and redundancy is eliminated.
- **Integral Technology.** The manual processes consist of: design review, implementation timing, tooling order, approval, and receipt confirmation processes. Those processes are improved by using an integrated system to reduce the distribution lead time.
- **Empower.** Eliminate the manager function in approval process by empowering Department Head and Section Head. This elimination is done because Department Head and Section Head are the owner of the processes and directly involve in technical document distribution process.
- **Resequencing.** The improvements consist of: 1) The handling process of technical document position is resequenced. Process resequencing is started from the process of storage, inspection, and registration. The aim of this improvement is to provide more accurate technical document data. 2) Technical document distribution process from PCD to Internal Plant is conducted after integrating the data from PIC of Company X and makes a parallel distribution to the Internal Plant. This process will be more efficient because all divisions in Internal Plant can receive the technical document in the same time, and avoid the waiting administration process in Internal Plant management.
- **Integration.** The delivery process of technical document from Company X to the suppliers is conducted by courier. This condition is improved by integrate the suppliers system with the company so that suppliers can receive technical document faster.
- **Parallelism.** Technical document can not be handled by the next divisions until the previous divisions finished the process. The paralellism is conducted to the following processes: receipt, delivery, design review, implementation timing, tooling order, inpection, and approval processes. Those processes will be done in parallel, so the other divisions can handle the technical document, without waiting for the other divisions finished to process it.
- **Numerical Involvement.** All administration functions in all divisions are eliminated, because under the new system, the administration function will be conducted by Engineering Administration Department.

The proposed new business process can be seen in Appendix 2. Engineering Administration Department will be the first department who send the information about the arrival of technical document to the other divisions, PE, PCD and PuD only wait for technical document from EAD. Then they can handle the document together via the integrated system. Next, their work results are combined and send to Internal Plant and suppliers afterwards.

C. Developing A Simulation Model for the Proposed Business Process

The simulation is run using 13 replications. The results show in Table 5. From the table, the distribution lead time of the proposed business process is 22,509 hours ~ 2,814 days (1 days = 8 work hours). If we compare this results with the actual lead time, it is found that the proposed system can reduce the distribution lead time by 99,94%.

TABLE V. TOTAL LEAD TIME USING 13 REPLICATION

Replication (n)	Total Lead Time (hour)
1	23,460
2	22,810
3	23,190
4	22,870
5	22,300
6	22,330
7	23,070
8	22,660
9	22,340
10	22,360
11	21,150
12	21,550
13	22,530
Average	22,509
Deviation Standard	0,634

D. SWOT-AHP Analysis

After reengineering the technical document business process and found the distribution lead time from the simulation, we analyze the readiness of the company in implementing the new business process using SWOT-AHP. In SWOT-AHP methodology, firstly, a SWOT analysis is carried out and the matrix is structured. The relevant factors of firm's external and internal environments are defined and built in the SWOT matrix. Three experts from the company are chosen to structure the SWOT matrix. AHP is used to determine the priority of the SWOT matrix. The hierarchical structure of the AHP is appeared in Figure 3.

Afterwards, pairwise comparisons are conducted, using Saaty's comparison scales [16]. The comparison results are shown in Table 6. SWOT factors are compared considering every SWOT group. All pairwise comparisons in this research are performed by the experts.

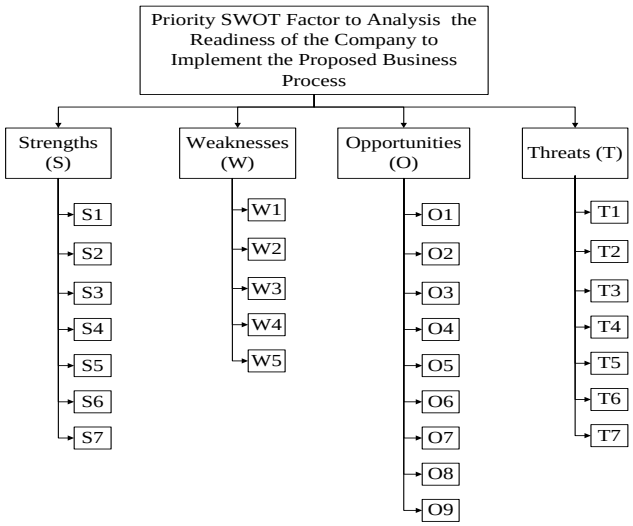

Figure 3: Hierarchical Structure of SWOT-AHP

TABLE VI. PAIRWISE COMPARISON OF SWOT FACTORS

SWOT Groups	S	W	O	T	Importance Degrees of SWOT Groups
S	1,000	3,000	2,621	2,621	0,442
W	0,333	1,000	0,322	2,621	0,161
O	0,382	3,107	1,000	3,302	0,295
T	0,382	0,382	0,303	1,000	0,102
CR = 0,107					

Finally, the overall priority scores of the SWOT factors are calculated. The overall priorities are shown in Table 7.

TABLE VII. GLOBAL PRIORITY

SWOT Group	Group Priority	SWOT Factor	Local Priority	Global Priority
S	**0.442**	S1	**0.277**	**0.123**
		S2	0.139	0.062
		S3	0.181	0.08
		S4	0.106	0.047
		S5	0.102	0.045
		S6	0.083	0.037
		S7	0.111	0.049
W	0.161	W1	0.143	0.023
		W2	0.157	0.025
		W3	**0.267**	**0.043**
		W4	0.201	0.032
		W5	0.231	0.037

SWOT Group	Group Priority	SWOT Factor	Local Priority	Global Priority
O		O1	0.148	0.044
		O2	0.082	0.024
		O3	0.114	0.034
		O4	0.244	0.072
		O5	0.101	0.03
		O6	0.11	0.033
		O7	0.04	0.012
		O8	0.127	0.037
		O9	0.032	0.009
T	0.102	T1	0.159	0.0163
		T2	0.058	0.006
		T3	0.178	0.018
		T4	0.079	0.008
		T5	0.146	0.015
		T6	0.092	0.009
		T7	0.163	0.0167

V. DISCUSSION

Reengineering the distribution system of technical document in Company x using BPR Best Practices has been conducted. The comparison between the existing and proposed business process are explained in the following passage:

- In the existing business process, the arrival of technical document from Principal Company is only known by Engineering Administration Department of Engineering Division. In the proposed business process, the information about the arrival of technical document can be viewed by all divisions in Company X who involved in the process including suppliers via pre notification to their email using email gateway technology.
- In the existing business process, technical document distribution process from Company X to the suppliers is conducted manually by courier. In the proposed system, it is integrated via online system.
- In the existing business process, data registration activities are conducted by each division when a technical document is received or sent to the next division. In proposed system, it is only conducted by Engineering Administration Department using integrated system, so that the data can be used in all divisions and suppliers.
- In the existing business process, the technical document can not be handled by next divisions before the previous divisions accomplished the process. In the proposed system, the technical document can be handled in parallel by the other divisions, and avoid the waiting time.
- In the existing business process, technical document's position is unknown by each division and suppliers. In the proposed system, the technical document's position can be tracked via integrated system by each division and suppliers.
- In the existing business process, the technical document can be sent to the next division, after it has been checked and signed by the manager in each division. The proposed system empowering the Section Head and Department Head in each department to control the process of technical document, because Section Head and Department Head are directly involved in the distribution process of technical document rather than the managers.

To determine the distribution lead time of the proposed business process, we develop a simulation model. Due to no data available for the simulation, the probability distribution functions of the processing time data needed in the simulation are determined by experts. We conducted interviews with several positions in the company who directly involved in the distribution process to determine their prediction concerning the processing time. Since the experts can only predict the minimum and maximum processing time, then uniform distribution is assumed. The type of the simulation used in this research is transient (terminating) since the starting and ending condition of the technical document distribution process can be determined certainly [20, 21]. The distribution lead time's result of the proposed business process is 2,814 days (1 days = 8 work hours). Based on the simulation result, it is found that the proposed system can reduce the distribution lead time by 99,94%.

In this paper a common significant tool such as SWOT analysis method is used to evaluate the readiness of the company to implement the proposed business process. In general, a SWOT analysis is used as a planning tool which has some drawbacks. The paper aims to show where some of these drawbacks can be overcome, and thus SWOT can be employed more successfully. This can be achieved by integrating SWOT with a decision analysis method (AHP). The result of AHP will produces the qualitative values for the SWOT factors. AHP method provides qualitative priorities to be used in decision support.

The integration of SWOT with AHP creates analytical priorities for the factors involved in SWOT analysis and makes them commensurable. The goal in applying this integration is to enhance the quantitative information basis of evaluation of the readiness of the company to implement the proposed business process. It is important to compare the demand and supply side and their possible relationships. The AHP analysis results indicate that the values of both strength and opportunity factors are higher than both weaknesses and threats. That leads to the fact that both demand and supply side in the initiation of reengineering project are important for

the success of the new business process implementation. It can also be seen that opportunity factors, are important for the new business process. On the other hand, the priorities of weakness and threat factors are low. The threat factors that required to aware of are also low in comparison to the opportunity and strengths factors. Hence, the overall results assure the feasibility of the new business process implementation in Company X.

VI. CONCLUSSIONS

This paper proposed an integrated distribution system of technical document in Company X using Business Process Reengineering (BPR) Best Practices. Several steps are employed in this paper: First, we map the existing business process of each division. Second, develop the business process using BPR Best Practices. Third, build a simulation model based on the new business process to determine the distribution lead time, and finally evaluate the proposed business process using SWOT-AHP. Based on the simulation, it is found that the proposed system can reduce the distribution lead time by 99,94%. This result shows that the prediction lead time of the proposed business process is much better than the lead time of the existing business process. Further research will focus on the design of the information system to support the business process reengineering.

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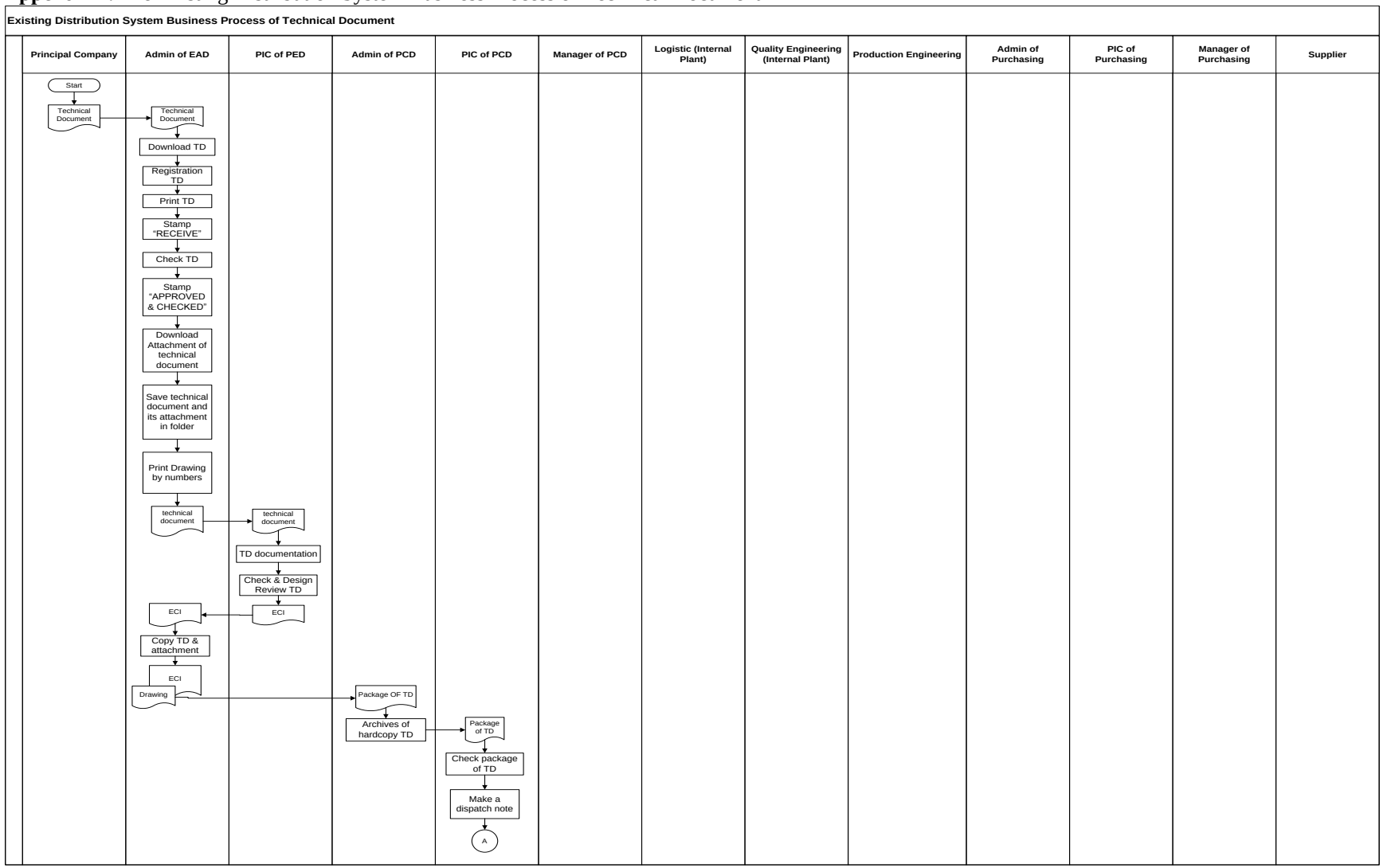
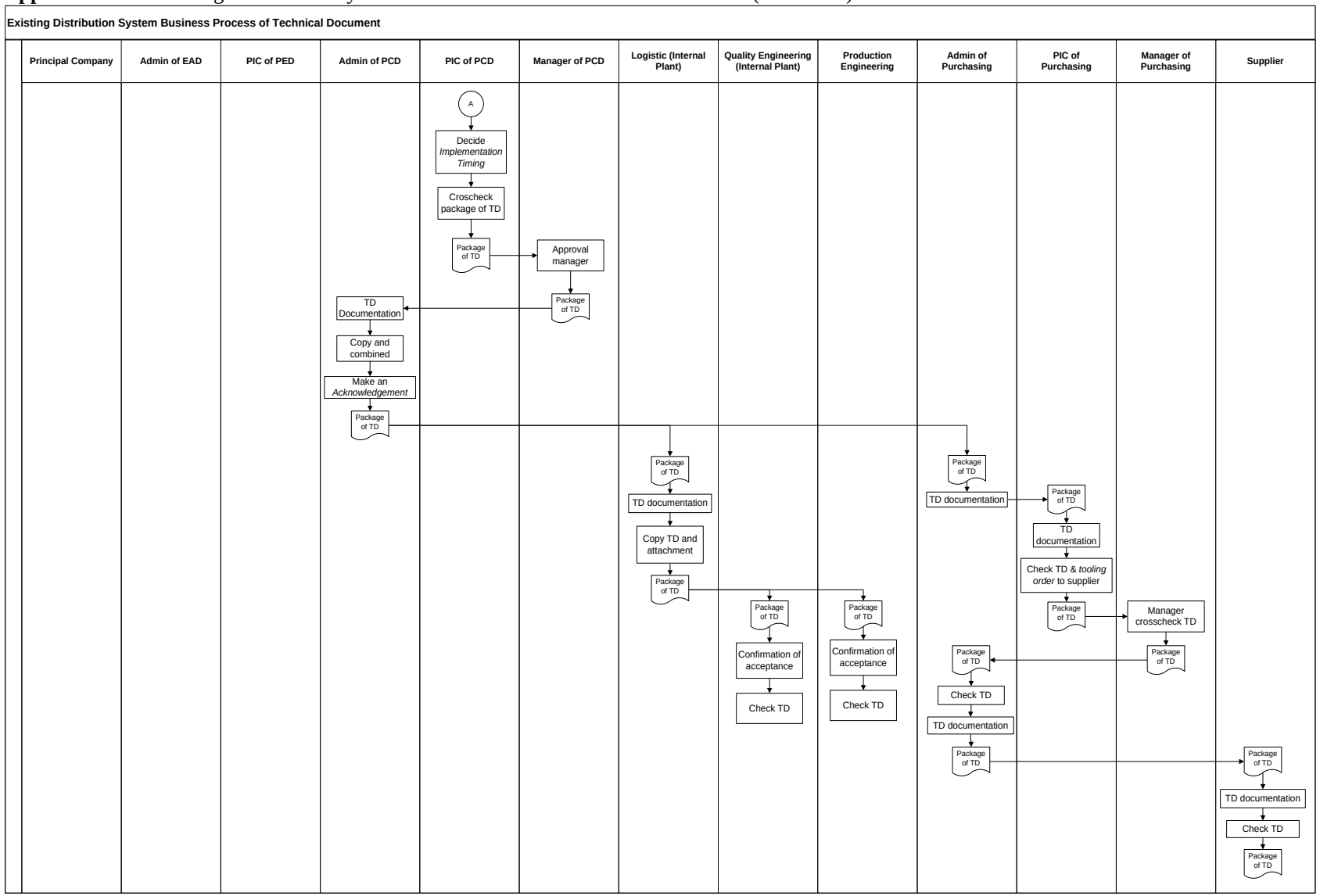
APPENDIX

Appendix 1. The Existing Distribution System Business Process of Technical Document



Appendix 1. The Existing Distribution System Business Process of Technical Document (Continued)



Appendix 2. Proposed Distribution System Business Process of Technical Document