

Business Process Mapping in Software Development Company

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Abstract—The concept of business process is a tool in managing corporate value chain. Business process mapping becomes essential in increasing the organization growth. Previous studies already identified the value chain in the software industry, but only develop in the level macro-process and have not mapped the business processes in detail. Macro-process needs to disaggregate into a more detailed process to implement in the organization. Therefore, this study aims to map the business processes run in a software development company. A qualitative case study conduct in an IT company engaged in software development. Data collected through interview with five representatives in the company. Findings in this study, there are 11 categories of processes; consist of six operating processes and five managerial and supporting processes. These business process map can be used as input to make the responsibility assignment matrix (RAM), activity relationship chart (ARC), and organizational structure for IT company.

Keywords—value chain, business process, business process mapping, software industry, software development

I. INTRODUCTION

In this millennial era, various information technology (IT) companies are increasingly emerging by offering innovations. One area that is quite developing is the field of software development. The development of the business requires the company to maintain the quality of the software from every project it does. Companies need to manage the value chain in the company. The value chain management can apply through a business process map [1]. Business process maps can be useful as a basis for measuring performance and designing the organizational structure, especially for small and medium-sized enterprises. Also, business process mapping helps in developing strategies and information technology. In the future, business process mapping can be used to reduce non-value added activity, reduce costs, and improve the quality of business process [2].

Therefore, it is essential for software companies to map their business process well. However, most small and medium scale companies do not have a business process map because they focus on carrying out the routine activities without regard to process standardization. The absence of

business process maps can have an impact on process inefficiencies and overlapping work. Moreover, previous studies never conduct business process mapping for software companies.

Previous research has discussed the value chain in the software industry [3-6]. However, the research only addresses the level of process categories, not yet explaining a detailed process for operationalization in the company. Benchmark with the Process Classification Framework (PCF) proposed by the American Productivity and Quality Center (APQC) can become input to map the business process. This PCF framework includes macro processes that can aggregate into sub-processes, activities, and tasks [7]. APQC has PCF for various industries; one of them is a telecommunications industry that is the most related to IT companies [8]. This study aims to map the business processes in IT companies will be carried out including macro-process (level 0) to sub-processes (level 2).

II. LITERATURE REVIEW

This section will discuss the concept of a value chain, business process, and business process mapping.

A. Value Chain

The value chain is a primary tool for examining all the activities a firm performs and how they interact systematically to perform a competitive advantage [1]. The value chain disaggregates a firm into its strategically relevant activities in order to understand the behavior of costs, existing source, and the potential source of differentiation.

The value chain displays total value and consist of value activities and margin. Value activities are the physically and technologically distinct activities a firm performs. Value activities can classify into two broad types, primary, and support. There are five generic categories of primary activities, which are [1]:

1. Inbound logistic: receiving, storing, and disseminating inputs to the product.
2. Operations: transforming inputs into final product form.
3. Outbound logistic: collecting, storing, and distributing

the product to the buyer.

4. Marketing and sales: providing a means and inducing the buyer to purchase the product.
5. Service: providing service to enhance and maintain the value of the product.

Support activities support the primary activities. There are four generic categories of primary activities, which are procurement, human resource management, technology development, and infrastructure.

Some previous studies have developed value chain models for the software industry [3-6]. Pussep et al. [3] develop a value chain model in the software industry by using several references, namely Porter's generic value chain, software specific value chain, and the software development lifecycle. From the results of the combination, a unified software value chain model is proposed, consisting of 11 categories, namely product research, procurement components, product development, user documentation, production and packaging, marketing, implementation, training and certification, maintenance and support, operations, and replacement.

Tyrvalinen [4] proposed a reference model for the software business. The proposed model was developed by considering several models for managing software activity within the software development and deploying software in firms, such as the Capability Maturity Model (CMM), IT Infrastructure Library (ITIL), Control Objectives for Information and Related Technology (COBIT). The proposed model covers five main categories in the software business, namely software development, strategy and business management, acquisition, customer interface, and asset management.

Farsi et al. [5] using the model of the software industry value chain includes the primary process and support groups following Porter's generic value chain [1]. The primary process group consists of inbound logistics, operations, quality assurance & configuration management, management, outbound logistics, marketing and sales, and services. While supporting process groups include infrastructure, technology development, and human resource management.

Rocheska et al. [6] proposed a model of the software industry value chain. The proposed value chain consists of two groups, namely the core value chain and enabling environment and support activities. The core value chain includes input management, software development process, output management, marketing and distribution, and post selling services. While the enabling environment and support activities group consists of ICT infrastructure, education and training, finance, and the legal and policy framework.

B. Business Process

The business process consists of a set of activities that performed in coordination in an organizational and technical environment. These activities jointly realize a business goal. An essential aspect of business process management is to increase customer satisfaction, reducing cost, and improving the process [2].

One framework that is often used to map business process is Process Classification (PCF) by the American Productivity and Quality Center (APQC). APQC is the world's foremost authority in benchmarking, best practices, process and performance improvement, and knowledge management that has build PCF for many industry sectors. PCF is a taxonomy of cross-functional business process that assists in aligning the company's business process to industry best practices and benchmark it. PCF facilitates the company to improve their business process through process management and benchmarking [3].

PCF telecommunication sector consists of 13 categories of the business process which organized into operating process and management and support service [3]. There are five categories of operating process, namely the process of 1.0 to process 5.0. There are eight categories of managerial and support service, namely the process of 6.0 to the process of 13.0. Table I shows the PCF telecommunication sector.

TABLE I. CATEGORY OF PCF APQC IN TELECOMMUNICATIONS [8]

ID	Business Process
1.0	Develop vision and strategy
2.0	Develop and manage products and services
3.0	Market and sell products and services
4.0	Deliver products and services
5.0	Manage customer service
6.0	Develop and manage human capital
7.0	Manage information technology
8.0	Manage financial resources
9.0	Acquire and manage property
10.0	Manage environmental health and safety (EHS)
11.0	Manage external relationships
12.0	Manage knowledge, improvement, and change
13.0	Manage and plan network

C. Business Process Mapping

Process mapping is the task of defining what exactly a business does, who is responsible, and what is the standard by which the success of a business process can be the judge [9]. Process mapping is an exercise to identify the significant steps and decisions in a routine workflow in the visual form [10]. It is essential for new employees to follow the process easily [9]. Process maps are helpful for cross-departmental communication and can be a critical first step in process improvement [10].

One way to map process is using iterative and extensive interviews, compile the map, and revisit stakeholders to revise and confirm its correctness [10]. In general, steps involved in business process mapping are [9]:

1. Identify the process that wants to be mapped
2. Gather information about the process from respondents interview
3. Identify the start and end point of the process
4. Break the process into distinct tasks and decision points

One tool to map the business process is using flowcharts. The most frequently used shape in the flowchart is rectangles. Rectangles shape represent actions and arrow represent the sequence of events. Each rectangle is connected to the other by an arrow [10]. After mapping correctly, the

business process mapping can be used to process improvement and re-engineering.

III. METHODOLOGY

This section will explain the profile of the research object and the research method used at each stage.

A. Research Object

The object of this study is an IT company engaged in software development. This company is a medium scale enterprise which establishes since 2007. This company provides services related to custom app development, training and education, and product software. The company has a variety of clients including state-owned and private companies.

B. Research Stages

A qualitative case study has been used to map the business process. This study began with a literature study of value chain model in the software industry that has explained previously. Then the comparison of the value chain categories was made as illustrated in Table II. The results of the comparison are 15 categories of processes in the value chain in the software industry. This process category will then be evaluated whether it is done in the case study company.

The interviews were conducted by in-depth interview with five representatives in the company, namely chief technical officer, business development manager, human resource manager, admin finance, and general affair. The in-depth interview steps are to set goals, design interview guide, interview, document the results of interviews, analyze, verify, and report the results of interviews. Interviews are carried out by giving open questions to each respondent to clearly describe the activities they do and the steps. There are four questions related to explore the business process as follow:

1. What are the business processes carried out in each division? What is the order of the process?
2. What are the knowledge needed to support the business process at point (1)? Where did the knowledge come from?
3. Who are the parties involved in the business process at point (1)?
4. When is the business process at point (1) implemented?

The answers of the respondents adjusted to the proposed model value chain category and PCF APQC telecommunications sector for the detailed sub-processes. Analysis of interview results to get the business process sentences is done using the open coding process. The last step is verification of the human resources development (HRD) manager of the company. This process repeated for all business process groups until a complete company business process map obtained.

TABLE II. VALUE CHAIN CATEGORIES IN PREVIOUS STUDIES

Chart	n	Develop vision and strategy	Previous Researches					Proposed Model
			[3]	[4]	[5]	[6]	[8]	
			×				×	×

	Previous Researches					Proposed Model
	[3]	[4]	[5]	[6]	[8]	
Research & Development	×	×	×	×	×	×
Logistics	×		×		×	×
Product Design & Development	×		×	×	×	×
Marketing & Sales	×	×	×	×	×	×
Manage Customer Services	×	×	×	×	×	×
Manage Human Resources		×	×	×	×	×
Acquire and Manage Property			×	×	×	×
Manage Financial Resources				×	×	×
Legal & Policy Framework		×		×	×	×
Manage Information Technology		×			×	×
Manage Environmental Health and Safety					×	×
Manage External Relationship					×	×
Manage Knowledge, Improvement, and Change					×	×
Manage and Plan Network					×	×

The existing conditions in a software development company as empirical data will use to validate the proposed business process categories. Hence, a business process carried out by the company. The business process mapping process is explained more briefly in the flowchart in Figure I.

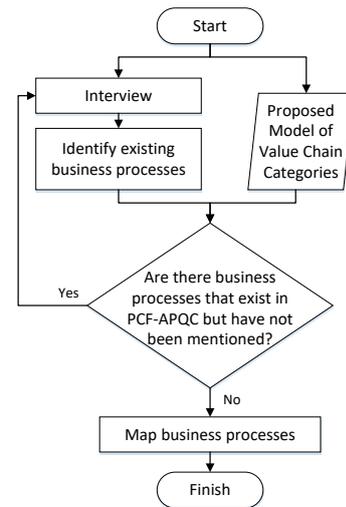


Fig. I. Flowchart of Business Process Mapping

The depiction of the business process using an integrated definition for function modeling (IDEFO) or data flow diagrams (DFD) often confuses stakeholders because too much information used. The methodology is not suitable for employees who want a business process map that is simple and easy to understand [11]. Therefore, a business process map will be described by a simple flowchart method using rectangles and arrows. A solid line arrow indicates that the process behind the arrow always produces input for the next process, while the dashed line arrow indicates that the process behind the arrow can generate input for the process in front of the arrow.

IV. RESULT AND DISCUSSION

In this study, we generated business process mapping up to level 2 for software development company. From the results of interviews, there were 11 categories of the business process carried out by IT companies in software development.

TABLE III. RESULTS OF EVALUATION PROCESS CATEGORIES

Proposed Process Categories	Result from Case Study (PC / DP / NA)*	Description
Develop vision and strategy	PC	Process Category "1.0 Develop strategic vision and mission"
Research & Development	DP	Include as detail process of "3.0 Conduct software development project planning"
Logistics	DP	Include as detail process of "3.0 Conduct software development project planning"
Product Design & Development	DP	Include as detail process of "4.0 Develop and manage software development project"
Marketing & Sales	PC	Process Category "2.0 Market product and services"
Manage Customer Services	PC	Process Category "6.0 Manage customer services"
Manage Human Resources	PC	Process Category "7.0 Develop and manage human resources"
Acquire and Manage Property	PC	Process Category "9.0 Acquire and manage property"
Manage Financial Resources	PC	Process Category "8.0 Manage financial resources"
Legal & Policy Framework	DP	Include as detail process of "10.0 Manage external relationships"
Manage Information Technology	PC	Process Category "5.0 Manage information technology"
Manage Environmental Health and Safety	NA	Not conducted in software development company
Manage External Relationship	PC	Process category "10.0 Manage external relationships"
Manage Knowledge, Improvement, and Change	PC	Process Category "11.0 Manage improvement and change"
Manage and Plan Network	NA	Not conducted in software development company

*PC = process category; DP = detail process; NA = not available

The focus of this research is to frame business process mapping for IT companies by considering the company's value chain. The results of mapping business process from level 0 to level 2 explained in the following section.

A. Visualization of level 0 business process mapping

Mapping business process results in operational process and managerial and support service as shown in Figure II.

The operational process is the primary process for operating business. Managerial and support service is the process that helps direct, manage, and monitor an operational process. Both processes provide input for each other seen from arrows that go back and forth between operational process and managerial and support service.

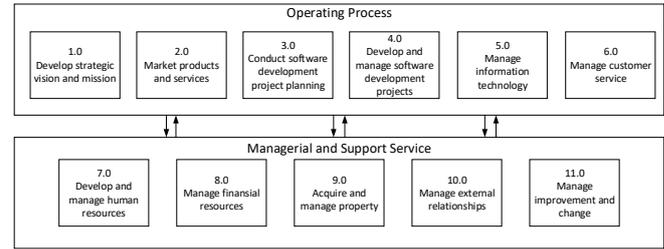


Fig. II. Level 0 Business Process Map

Based on evaluation with existing conditions, there are changes in grouping process categories compared to the proposed model according to Table III. The research and development and logistics process categories are included in software development project planning because in the existing conditions both are part of project preparation. Legal and policy framework includes managing external relationships because in this process category includes managing relationships with government.

Two process categories are omitted from the proposed category (seen in Table III), namely managing environmental health and safety, and also managing and plan network. IT companies do not manage the safety and health of the work environment because the employee's workplace is relatively safe compared to the workplace of a manufacturing company. The software company did not do business network planning and management due to its limited scope, so this category eliminated in the proposed business process map. After elimination, managerial and support service consist of 5 process categories, namely, develop and manage human resources, manage financial resources, acquire and manage the property, manage external relationships, as well as manage improvement and change.

The operational process consists of 6 process categories, namely develop strategic vision, market products, and services, software development project planning, develop and manage software development projects, manage information technology, and manage customer service. The finding of these categories also aligns with the proposed core process for software SMEs from Aisha et al. [12]. Core processes for software SMEs include software development, marketing, research, and maintenance [12]. The process categories are different with PCF APQC because the work in software development company is relatively project-based, that mainly focused on client-related process. Besides, the managing information technology category is included in the operational process because it is crucial for IT companies to manage their information technology.

Each process category has a relationship with each other. The process category of develops a strategic vision and mission providing input to managerial and support service. The five other process categories in the operational process user input from managerial and support service to support

the implementation of the process category. Analysis of the relationship between process categories will be carried out at the next level. This managerial and support service needs to be carried out properly to support the implementation of the optimal operational process.

B. Visualization of level 1 business process mapping

The two process categories are decomposed into process groups (level 1 business process) to get detailed. Figure III is a map of the level 1 business process map in an IT company software development. It describes the relationship of the processes in it.

In the operation process, each process category has several process groups. For example, the process category of developing a strategic vision and mission has five process groups, namely define the long-term business concept vision, develop business strategy, develop project strategy, manage business development, and manage corporate planning.

The managerial and support service of software development company tend to be similar to the process used by companies in general. In mapping, the level 1 business process for managerial and support service, PCF APQC is used as a reference so that companies can follow best practices used by companies that have been successful. PCF APQC helps to accelerate the duration of mapping the business process of software development company. The five process categories described in more detail in several process groups. For example, the process category of acquiring and manage assets consists of 3 process groups, namely manage the procurement of assets, manage assets maintenance, and save assets.

In operation process, the process group of manage corporate planning can be input for the process group of develop a project strategy seen from the dashed line connecting the two processes, although the primary input is the process group of defining a long-term business concept

vision. In managerial and support service, the process group of manage employee information and the process group of process payroll associated with an arrow that has two arrows pointing to the two process groups. It indicates that both provide input and output to each other. The process group of manage employee information can provide input in the form of employee attendance lists that will be used to process payroll. The process group of process payroll provides employee payroll information.

A process group can be input for several process groups and get input from several process groups. For example, the process group of manage offers from the market can be an input for the process group of plan human resource needs, calculate project time, and calculate project costs. Also, the process group manages project gets input from many process groups.

C. Visualization of level 2 business process mapping for operation categories

The result of business process mapping in level 2 for operation categories can be seen in Appendix A. At this level 2, the process group is decomposed into more detailed processes.

In the operation process, the process category of developing strategic vision and mission is carried out by the highest management of the company, such as CEO, CTO, CFO, CMO, and COO. In software development companies, fulfilling client requests is done through marketing in advance to get clients. Marketing starts by understanding the target market, planning, and execution to get a client. The process conducted sequentially as in Appendix A. Then, project planning is executed. The product requirements of each client are varying, so the different treatments are needed for each project. The planning process starts with benchmarking, planning resources, costs, time, and building cooperative relationships with other vendors. When the plan has been completed, the company can carry out the project.

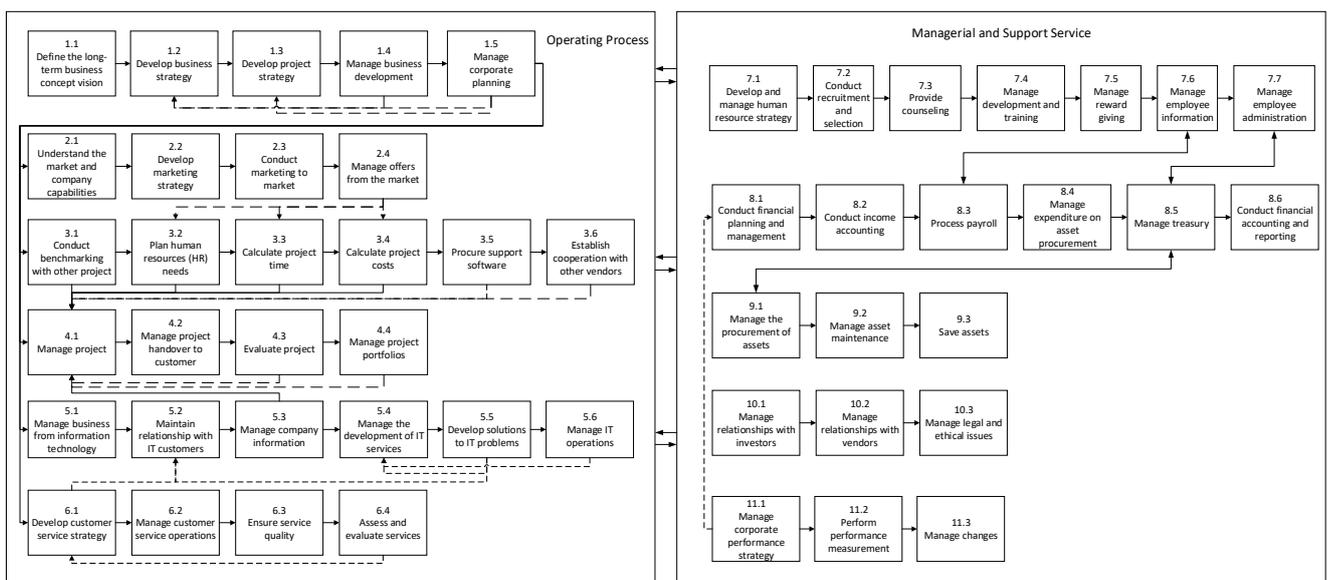


Fig. III. Level 1 Business Process Map

The implementation of this project also requires input from the process category of manage information technology which is a technical input for project implementation. The completed project needs to be handed over to the client. Then, an evaluation of each project is done based on client feedback and the results of key performance index (KPI) achievement. Moreover, the company needs to manage the client questions, complaints, and feedback to the company or project. It can be an input to do research and innovation.

In practice, the results of the business process map in this study can be used as a reference in mapping business process for IT companies. Directly, the business process map is useful for companies to know the processes that provide added value or not, so the process can be optimized or eliminated. Besides, the business process map can be used as input to make the responsibility assignment matrix (RAM), activity relationship chart (ARC), and organizational structure for IT company.

V. CONCLUSION

Business process map for IT companies in the field of software development has been successfully visualized by simple depiction methods. Simple visualization makes employees easy to understand the business process map quickly and accurately. PCF APQC helps to categorize the business process according to the characteristics of the company.

The results of the visualization can be used by each in the company to understand their respective functions well. This simple depiction is suitable to be carried out up to a level 2 business process. For the next level, a better depiction with various detailed information needed. Furthermore, the core business process of an IT company is the operational process. The core business process is a critical process to develop the business of the company well.

From the results of interviews, there were 11 categories of the business process carried out by IT companies in software development, consist of operating process and managerial and supporting process. The operational process consists of six process categories, namely develop strategic vision, market products, and services, software development project planning, develop and manage software development projects, manage information technology, and manage customer service. Meanwhile the managerial and supporting process consists of five process categories, namely develop and manage human resources, manage financial resources, acquire and manage property, manage external relationships, and manage improvement and change.

The weakness of this research is the research conduct only in one case study, represent the project software business. To get a more generic process mapping in the software industry, it is recommended to do similar research in other software companies with the different types of business, such as software product business and hybrid software business. Also, further research is expected to map the business process of IT companies in other fields such as e-commerce. Furthermore, to continue this research, analyzing the organizational design would be worthwhile to decide the job responsible for each process.

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Appendix A Business Process Mapping Level 2 for Operating Process

