CHAPTER 2

LITERATURE REVIEW AND THEORITICAL BACKGROUND

This chapter will discuss about Business Process Improvement. This chapter also will provide a broad perspective between previous research and the correlation with this research.

2.1. Previous Research on Business Process Improvement

Business process is a strong and powerful approach used for organizations to elevate the outcome. A successful business process is not only focusing on the comparison between before and after the improvement, but also the actual act of the improvement. (Forster, 2006).

To achieve improvement of a process in an organization, it is important to recognize the actual situation, and define the weak points of process. It is required to investigate many business process methodologies to define their effectiveness and their capabilities that suits with the problem in an organization. (Rashid, 2011).

Griesberger et al. (2000) defined BPI as a methodology that has been designed to achieve the improvement by changing the part of elements of an existing business process. The part after the improvement elevates the state before the improvement that is leading to the accomplishment of organizational purpose, which improves the performance of organization's business process. BPI is a methodology that is required to analyse the business process activity of an organization, in order to remove any delays in the whole processes (Raed & Zaini, 2015).

BPI is defined as a noetic form of reverting instance of a process modification step used in a business process. The modification steps are undergone to revamp the process, organization, data, object, or generally in all business process related issues. Using BPI patterns as an attempt to describe successful solutions to BPI steps. (Forster, 2006).

According to Raed & Zaini, (2015) in the research of building intelligent framework for building business process management, there are several

techniques to achieve business process improvement, and it is suggested to use data mining technique as this has been applied in one of a software company in Brazil, and this is extremely useful although it needs a log life and data mining does not provide an instant result.

Bhatt & Troutt (2006) concluded the IT imperative takes an extreme position.. The result shows how IT integration can be instrumental in affecting customer focus. At the same time, IT integration can be an organizational choice for bridging the relationship between BPI and customer focus. IT expertise is quite critical because it is likely to support the change. IT has the means to generate ongoing improvements in accuracy and timeliness.

Shendryk & Boiko (2015) stated the objective of a reseacrh conducted is to achieve universality in the business process through process approach during design. The improvement in design is specifically be changed in information system design. The use of process-oriented methodology during the design of information system allowed to implement the service oriented architecture, and considered the model of IS as a set of a service level and the level of business processes that are connected each other sequently.

According to Moon et al. (2011) BPI in recent years has emerged as a major development to ease the understanding and evolution and communication. BPI have changed continuously with the change of development of information technology (IT). Using software or applications are essential to manifest the agility and flexibility of business process.

Lars et al. (2016) found business process has an importancy with IT management. The role of IT has a significant result of the integration between functions in an organization, to enable strategic and operational business. The process of planing level, strategic, and decision making also requires an integration of IT as a strategic driver.

Najjar et al. (2012) discovered there has been some lacks of empirical research regarding to the role of IT in process improvement of organizations. Research in a firm showed at organization that adapt to tools alone (Six Sigma, TQM, BPR, etc.) cannot achieve the same result of business performance than organizations that applies both IT and one of a tool of business process. This research also resulted that the significant of applying IT in an organization demonstrates and

impactful outcomes of effectiveness and efficiency in lowering cost, lowering the process variability, and also reducing lead time.

2.2. Business Process Improvement's Methodologies and Approaches

BPI has variety of methodologies, such as lean management, six sigma, total quality management (TQM), kaizen, just-in-time, design of experiment (DOE), or business process reengineering (BPR). The core of those methodologies is to streamline the process, reduce costs in all types, and remove waste. (Najjar, 2012).

There is no specific methodology that is flexible to be applied in all situations. This happens because not all organizations have same business characteristics of process. It is required to investigate the actual problem with several steps, compare the methodologies, and choose the most suitable methodology that can be applied to the problem. There is no best methodology of BPI as this is contextual and follow the needs of organizations.

Following the steps to implement BPI from upstream to downstream, Adesola & Baines (2005) described MIPIM seven generic steps that can be used in any business situation. These seven generic steps are designed systematically to implement BPI. The steps are shown in the Figure 2.1.

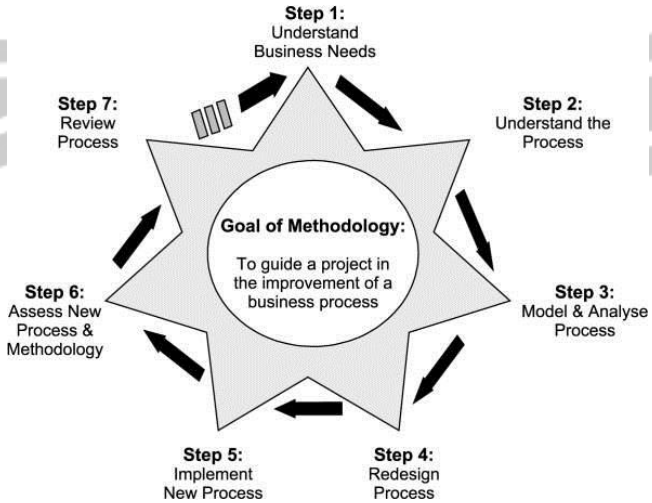


Figure 2. 1. MIPIM Seven Generic Steps (Adesola & Baines, 2005)

a. Understand Business Needs

This step is to assess previous work that is probably needed by the organization. This step to identify the process to be improved, define the objectives, and the impact of improvement,

b. Understand the Process

This step defines the established process, the boundaries, and also identify the persons behind the process,

c. Model and Analyse Process

It is required to portray the information to show the activities and the flows of communication and information. This step enables organization to understand the current business process that is actually performed,

d. Redesign Process

This step includes measurement, identification, and selection for improvement,

e. Implement New Process

This step is to realize and act the process that has been redesigned. However, it is required to plan before running the action, to ensure a successful implementation,

f. Asses New Process and Methodology

This step is to measure the impact of implementing new process with new methodology. Assessing new process needs to be done in particular of time, not just in a onetime implementation,

g. Review Process

This is to analyse whether the improvement is significant to organization or not, and this may lead to next cycle of improvement.

Adesola & Baines (2005) described the five general phases that these seven generic steps can be assigned to each of phase. The five general phases are initialization, diagnosis, design, implementation, and process management.

Based on research of Adesola & Baines (2005), understanding the business needs and the process can make into initialization phase. The tool that can be used is flowchart, to comprehend the entire process. Modelling and analysing the process can make into diagnose phase. Redesign process goes to design phase. Implementing new process belongs to implementation phase. And the last, assessing new process and methodology and review process make it to the process management phase.

Table 2.1. lists the comparison of previous researches' method used in five general phases.

Table 2. 1. Comparison of Previous Researches

Author	Methodology	Phase				
		Initiation	**Diagnosis**	**Design**	**Implementation**	**Process Management**
(Forster, 2006)	Business Process Lifecycle	Understand the process	Select the process	Improve business process pattern framework	Execute new BP pattern	Review process
(Rashid, 2011)	Business Process Management	Prepare for BPI	Analysis the strength, weakness, and objective of each BPI technique	Improve business process	Execute new improved business process	Continuous improvement
Griesberger et al. (2000)	Matrix	Data collection and validation	Qualitative analysis	Brainstorm and discuss	Implement result of discussing	Continuous process improvement based on matrix
(Raed & Zaini, 2015)	Process re-design	Develop the objective of a process	Quantitative data analysis	Design the IT framework	Execute IT framework	Review process

Table 2.1. Comparison of Previous Researches (Continued)

(Bhatt & Troutt, 2006)	Process re-design	Analyse the process and characteristics	Qualitative analysis	Task elimination and task composition	Simulate the elimination and composition	Review simulation using comparison table
(Shendryk & Boiko, 2015)	Process re-design	Understand the objectives of process	Qualitative analysis	Improve based on a gap between objective and current activities	Implement the improved business	Continuous improvement
(Moon et al. 2007)	Process re-design	Develop the objective of a process	Quantitative data analysis	Design the IT framework	Execute IT framework	Review process
Najjar et al. (2012)	Business process re-engineering	Understanding the need	Survey and quantitative analysis	Design IT framework	Execute IT framework	Review and evaluate process
(Lars et al. 2016)	Business process re-engineering	Understanding the need	Develop and analyse the system	Design IT frame work	Execute IT framework	Review process

The research from Najjar et al. (2012) discovered the significant of applying IT and combine it with one of a methodology, it was BPR in this research, in an organization demonstrates and impactful outcomes of effectiveness and efficiency in lowering cost, lowering the process variability, and also reducing lead time.

Research from Raed & Zaini (2015) stated that in order to provide intelligent business process that impactful to organization, it is better to have process framework by increasing system efficiency through improvement of information technology. This IT development will reduce cost, increase effectiveness, and increase the usability for developers and also business users.

2.3. Business Process Mapping

Business process mapping is an activity to identify whole processes of workflow, by providing the flow of information, materials, and documents involved in the processes. One of tools to map the process is flowchart. Flowchart is a tool to map the process by picturing the process of outputting something, from upstream to downstream. The standard flowchart symbols used in this research is drawn in Microsoft Office Visio 2016, and is shown in Table 2.2.

Table 2. 2. Standard Flowchart Symbols

Name	Symbol	Function
Terminator		To state the start and end of process
Process		To explain a process
Predefined Process		To define the process that is run elsewhere
Manual Operations		To indicate operation that is being done manually
Decision		To indicate what will be taken next, based on a question on decision symbol

Table 2.2. Continued

On-page Reference		To describe a detached step on a same page
Input/Output/Data		To state the input, output, or data

2.4. BPI's Performance Measurement

In the last step of five phases presented by Adesola & Baines (2005), the last step is process management. Process management is a set of activities that evaluate or review the implemented improvement in business process of an organization. To measure whether the implementation is significant or not, it is required to have a method or tool to measure the performance.

Buavaraporn (2010), described key measures, especially in an Operations process, there are four important measures. Those are cycle time, work-in-process (WIP), rework, and non-value-added or waste.

Barrak et al. (2017) defined Work In Process (WIP) as raw materials, sub-assemblies or partially completed products that are not yet part of the finished goods inventory, but also no longer part of materials inventory. WIP is sometimes stated as goods in process. Areshankar (2018) conducted a research of eliminating Rework using Six Sigma methodologies. The objectives is to minimizing process time, as rework is an activity where a defect product is being re-worked because of certain parameters that are not equal with the actual parameters of a finished product.

Wavhal, et al. (2017) stated that cycle time is a required time for performing various operations at production floor. Cycle time reduction is highly necessary today, since long cycle time results in high idle time, high cost and cut the productivity. Cycle time can be considerably reduced by proper demand management. For this research, can be used to by creating a system for an operation that will reduce cycle time. Reduction in cycle time holds the

advantages of reduced cost and effective utilization of resources. (Wavhal et al., 2017)

Eswaramurthi (2013) stated principle of operations activity is reducing process time and eliminating all wastes for adding more value added into the whole process. Waste or non-value added as any activity that does not add value to the product. It is also described that every activity is categorized as either a Value Added (VA) or Non-Value Added (NVA) activity. Non-value-added activity known as seven wastes can be defined as transportation, inventory, motion, waiting, overproduction, overprocessing, and defect.

The idle time for workers includes small postponements between processing of units.When time is being used ineffectively, the waste of waiting occurs. This waste occurs whenever the objects of the process are not moving or being worked on. This waste affects to such each spending time waiting. (Namrouty, 2013).

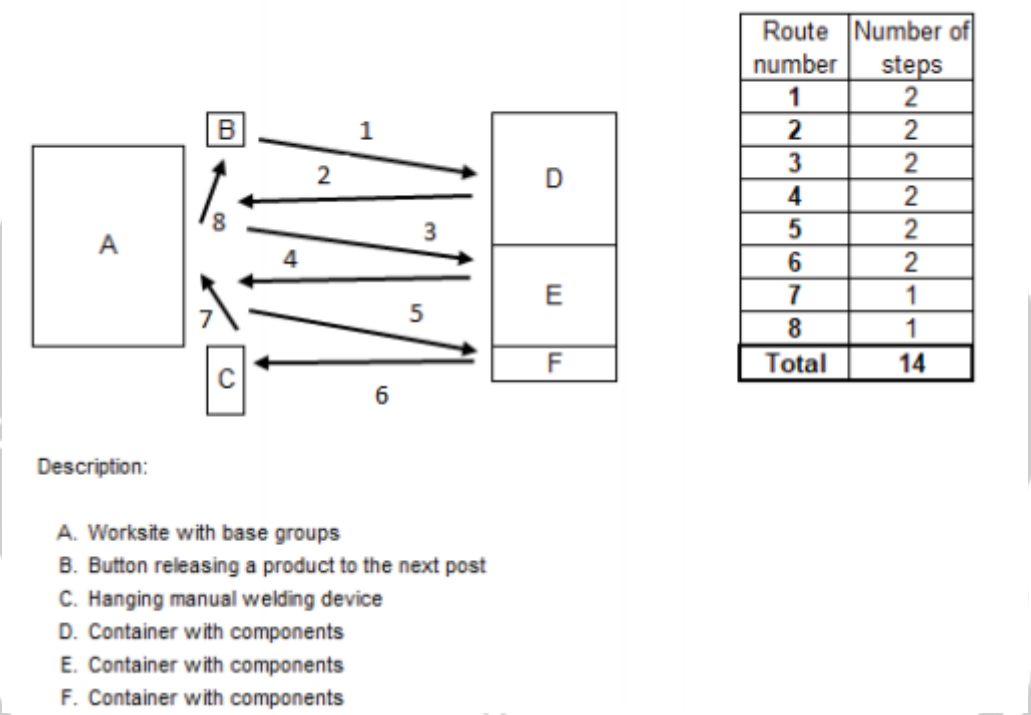
Motion waste refers to unnecessary labor movement in the workspace or production floor to accomplish the job (Kateb, 2015). It includes unnecessary physical motions or walking by workers which add them additional time from processing work. This might includes walking around the production floor to look for a tool or unnecessary or difficult physical movements, or to look for a person. (Namrouty, 2013)

Over-processing occurs when the situation overly complex solutions are found to only simple procedures(Hines and Rich, 2007). The over-complexity discourages ownership and encourages employees to overact and leads to large time.

2.5. Spaghetti Diagram

Spaghetti diagram, known as Spaghetti Chart or Spaghetti Plot is a tool to draw the movement in a system, with the help of line and maps. The movement could be material flow or worker flow. Usually Spaghetti Diagram is used in a production area, workshop, or in a specific building. Using Spaghetti Diagram the movement of material os worker tat depends on the object of the research, can be tracked. To distinguish each movement, each line can be drawn into different colors, or each line is stated with number, as the number defines the sequence of the activity.

The result of drawing spaghetti diagram is an ability to analyse the number of movements, movement lengths, or overlapping or crossing movements. The analysis then will lead to an identification of innefficient movements or ineffective area, where the acton after could be by eliminating number of workers, re-arranging workstation layout, or make a new system or procedure that does not require any movement.



Route number	Number of steps
1	2
2	2
3	2
4	2
5	2
6	2
7	1
8	1
Total	**14**

Figure 2. 2. Spaghetti Diagram Example (Domagala, 2018)

The example in Figure 2.2. shows the flow of worker in a certain workstation. The line is drawn with arrows and given a number of sequence. This shows from the worker does eight movements, where in each destination of movement, worker does several steps or activities. From the example it can be stated that the improvement could be by minimizing the movement, re-designing the layout, or eliminating the process. This spaghetti diagram will show how to do further after describing the movement or flow.

2.6. Integration and Definition Language 0 (IDEF0)

Problem definition and analysis can use the IDEF0 (Integration and Definition Language 0) model. IDEF0 is a functional modeling that uses the basis of SADT (Structured Analysis and Design Technique), developed by Douglas T. Ross of

SofTech in the 1970s which functions to design and implement designs in accordance with requirements. IDEF0 has a comprehensive and expressive characteristics, which means it is able to explain the level of business processes in detail. IDEF0 also uses understandable language, so that it is easy to understand and can provide detailed explanations and ease of communication between all parties. IDEF0 consists a set of activities that uses ICOM (Input, Control, Output, and Mechanism) to realize its task. The description of ICOM are in the following:

a. Input, meaning an initial data required in an activity
b. Control, meaning a medium that controls an activity
c. Output, meaning a result of an activity
d. Mechanism, meaning an individual or a person, a machine, or a certain facility that runs the activity

ICOM description can be seen in Figure 2.3.

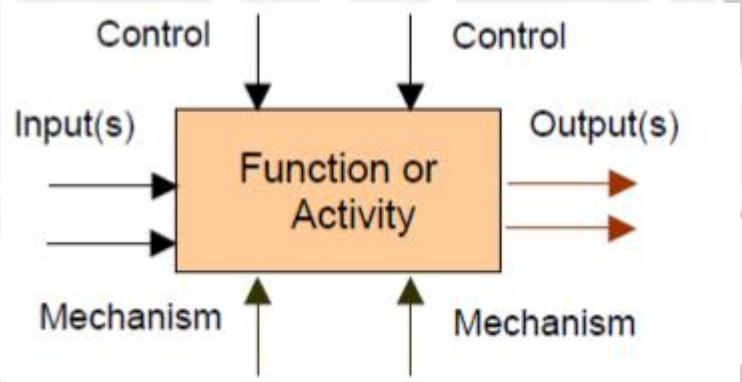


Figure 2. 3. ICOM

In the formation of IDEF0, several components are needed so that business processes can be clearly described. The following components that require to be elaborated are as follows.

a. Box, this component provides an explanation as the main function of the system. b. Arrows, this component is used to describe data that will be categorized as input, control, output or mechanism.

2.7. Unified Modified Language (UML)

Unified Modified Language (UML) is a method used by visualizing, constructing and documenting to be easily understood in order to achieve the model development. UML provides an overview of the boundaries and functions of a

system in general. To describe UML, Shelly and Rosenblatt (2012) divide into 5 methods, including:

2.7.1. Use Case Diagram

Use case diagram is a model that functions to show how information systems interact with users (Shelly and Rosenblatt, 2012). In this model the user is acts as an actor who interacts with the system. The example can be seen in Figure 2.4.

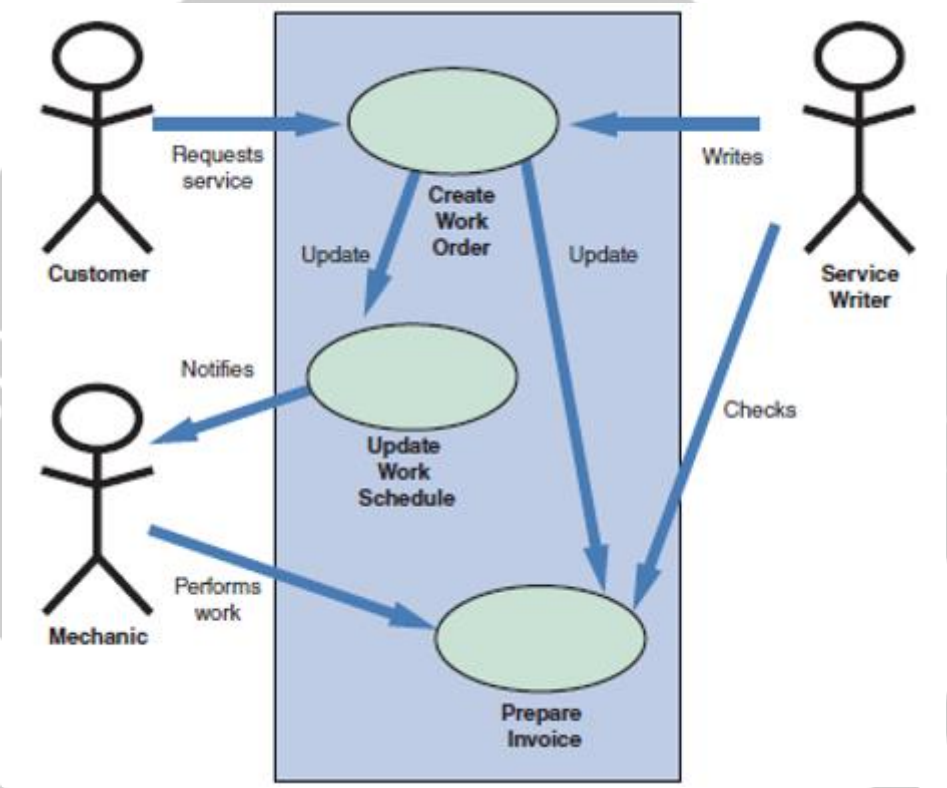


Figure 2. 4. Use Case Diangram Example (Shelly and Rosenblatt, 2012)

Detailed information for each use case can be illustrated using the use case description. Use case description can describes each picture in detail. There are 2 types of use case descripton, Brief use case description and Fully developed use case description. Brief use case description is used for simple and small cases. Meanwhile, Fully developed use case description is the most formal method with the possibility of clarity of a better and broader business process design. The fully developed use case description will be described as shown in Figure 2.5.

Use case name:	*Create customer account.*	
Scenario:	Create online customer account.	
Triggering event:	New customer wants to set up account online.	
Brief description:	Online customer creates customer account by entering basic information and then following up with one or more addresses and a credit or debit card.	
Actors:	Customer.	
Related use cases:	Might be invoked by the *Check out shopping cart* use case.	
Stakeholders:	Accounting, Marketing, Sales.	
Preconditions:	Customer account subsystem must be available. Credit/debit authorization services must be available.	
Postconditions:	Customer must be created and saved. One or more Addresses must be created and saved. Credit/debit card information must be validated. Account must be created and saved. Address and Account must be associated with Customer.	
Flow of activities:	**Actor**	**System**
	1. Customer indicates desire to create customer account and enters basic customer information.	1.1 System creates a new customer. 1.2 System prompts for customer addresses.
	2. Customer enters one or more addresses.	2.1 System creates addresses. 2.2 System prompts for credit/debit card.
	3. Customer enters credit/debit card information.	3.1 System creates account. 3.2 System verifies authorization for credit/debit card. 3.3 System associates customer, address, and account. 3.4 System returns valid customer account details.
Exception conditions:	1.1 Basic customer data are incomplete. 2.1 The address isn't valid. 3.2 Credit/debit information isn't valid.	

Figure 2. 5. Use Case Description (Shelly and Rosenblatt, 2012)

a. Use case name: Filled with use case that will be explained.
b. Scenario: Contains the name of the scenario of the use case that will be explained. iTrigerring event: Contains events that will trigger a use case.
c. Brief description: Contains a summary that covers generally the use case that will be explained.
d. Actors: Contains users of the related system.
e. Related use cases: These are other use cases that are related to the use case that will be run.
f. Stakeholders: Contains parties who have an interest relationship.
g. Preconditions: These are initial conditions that must be met before the use case continues.
h. Postconditions: These are conditions that have occurred after the use case has been run.

i. Flow of activities: Contains a detailed flow of activities carried out from the use case to be carried out.
j. Exception conditions: Contains a description of specific activities carried out if the use case is fulfilled

2.7.2. Class Diagram

Class diagram is a diagram of the the involved relationships in use cases that function as information system logic. Class diagram gives a picture of an object structure in a system that is divided into interrelated classes.

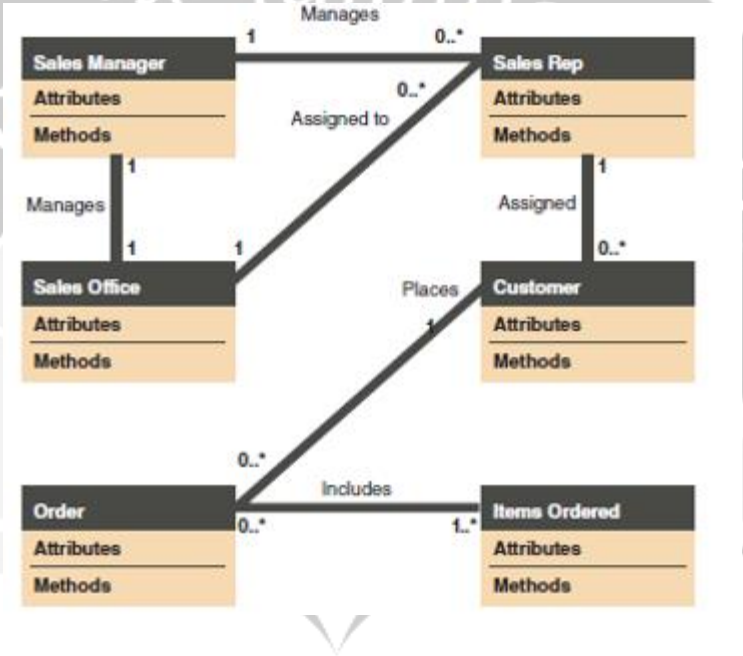


Figure 2. 6. Class Diagram (Shelly and Rosenblatt, 2012)

2.7.3. Sequence Diagram

Sequence diagram is a dynamic model of use cases that is used to show interactions between classes within a certain period of time.. In this diagram, a class, message and time from a use case will be documented. The example of Sequence Diagram is shown in Figure 2.7.

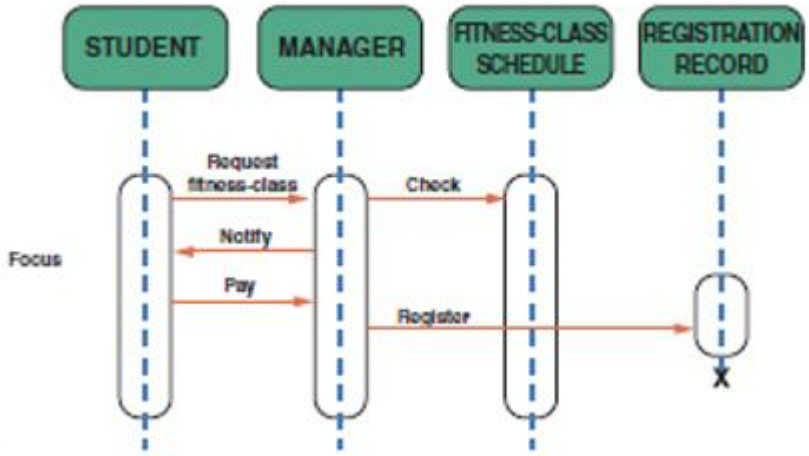


Figure 2.7. Sequence Diagram (Shelly and Rosenblatt, 2012)

2.7.4. State Transition Diagram

State transition diagram is a diagram that will show the process of changing an object from one place to another that will affect other objects.

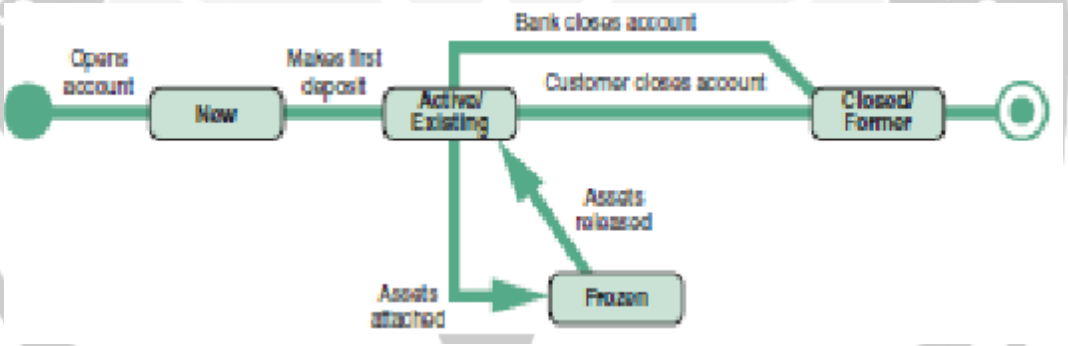


Figure 2.8. State Transation Diagram (Shelly and Rosenblatt, 2012)

2.7.5. Activity Diagram

Activity diagram is a diagram that shows the sequence of actions and identification of the results that will occur. all actions and identification will be described from the beginning of actions to the end.

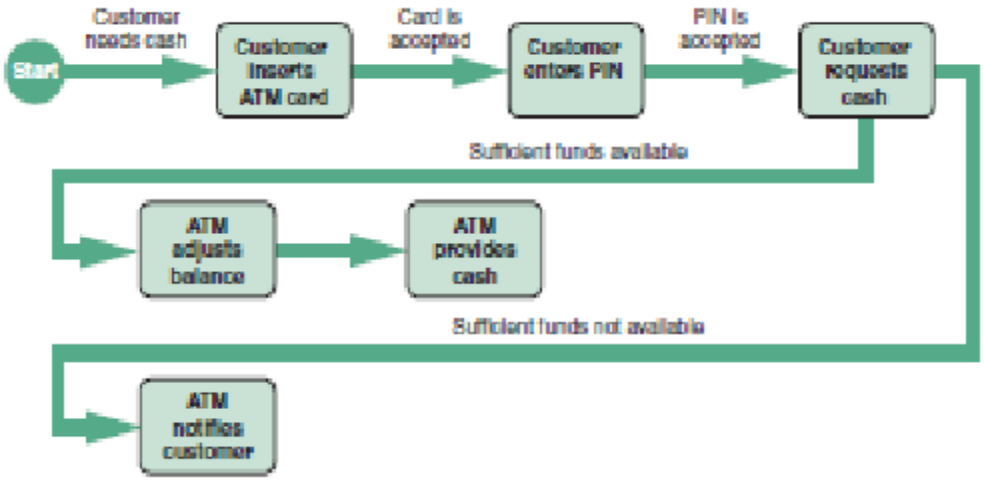


Figure 2. 9. Activity Diagram (Shelly and Rosenblatt, 2012)