

## **Exploring the Suitability of UML as a Business Process Modeling Tool**

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### **Abstract**

In this paper, we explore the applicability of UML (Unified Modeling Language) as a Business Process Modeling tool (BPM). BPM is a critical component of any business improvement process; it allows capturing a broad outline and procedures that govern what it is a business does. This model provides an overview of where the proposed system will fit into the organizational structure and daily activities. Although there are quite a lot of modeling techniques, there is no a well-defined standard. Moreover, these techniques support wide range of definitions and notations. Meanwhile UML is based on well-defined meta model governed by an international research group (OMG: Object Modeling Group) and becomes a de-facto standard for software modeling. Its rich modeling tool, with different visual diagrams and notations, makes it a promising candidate for modeling any business process. A case study is presented to better understand how UML can be used as a BPM tool.

**Keywords** Business Process Modeling, Unified Modeling Language, Modeling, Meta Modeling.

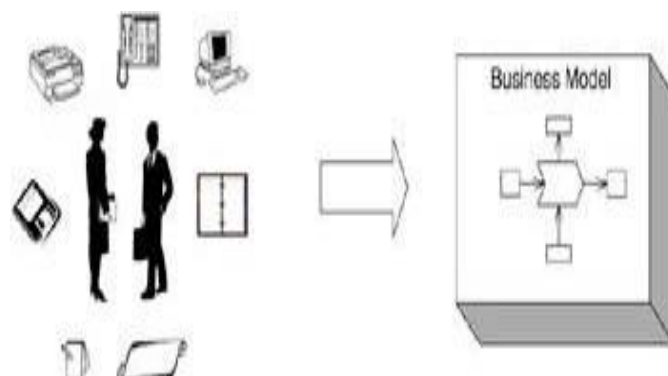
## 1. Introduction

Business organizations worldwide work competitively, which leads to the need of improving their competitiveness. This involves increasing the quality of their products and services, and to reduce costs and improve profits. To gain competitively, organizations must improve their inner operations and this process needs a business model that represents the business composition, letting the organizations to accomplish the analysis and the simulation of work before its execution [1]. Previously, the business has been represented with hierarchical models of organizational structures. However, the business can be improved through the optimization of its business processes. A business process represents the organizations system of work, beside allowing a study of the workflow through their inside and outside limits [1]; Business processes are essential since they define the order of work, keep the competitive advantage, increase the quality and decrease maintenance costs [2]. Subsequently business processes can become multifaceted and hence hard to analyse, understand, or explain. Due to the fact that business processes tend to grow larger and more complex with age, then they should be managed properly. Therefore, models of processes are used to represent a business process [3]. Although there are quite a lot of modeling techniques and these techniques use different notations, but they are used to model similar processes. The focus was on visual notations, which have a readability advantage over non-visual notations. Visual notations make it possible for organizations to improve their business processes and communicate them with partners to simplify business to business transactions. Meanwhile, in software projects UML (Unified Modeling Language) is becoming a de-facto standard for modeling software systems with its well defined meta-model and its different varieties of diagrams that represent different views of the system [13]. In this paper, we

explore the applicability and suitability of UML as a Business Process Modeling (BPM) tool.

## **2. Business Process Modeling**

To keep up and stay competitive, companies and organizations must evaluate the quality of their products and the efficiency of their services. They should consider their competitors, subcontractors, dealers, and clients as well the ever-changing laws and regulations. Besides, they must independently examine their products or services, by answering such inquiries as: Is my internal process running smoothly? If possible improve my product or service in different way? If the production processes are efficiently? Possibility of developing the product or service portfolios to get new markets and customers? [1]. Recently, business group must also evaluate their own information systems, if their way of business effectively supported, if the systems adapt to changing, if the used information are an significant resource in the business, if the information satisfactory and correct. All businesses will benefit by gaining a deeper understanding of how their business interacts with its environment, which comes from answering these questions. To answer these questions, it is necessary to create a model of the business, a simplified view of a complex reality (Figure 1). It means creating abstraction that enables you to eliminate irrelevant details and focus on one or more important aspects at a time. Effective models also facilitate discussions among different stakeholders in the business, helping them to reach agreement on the key fundamentals and to work toward common goals. Modeling is an accepted and established ways of analyzing and designing systems.



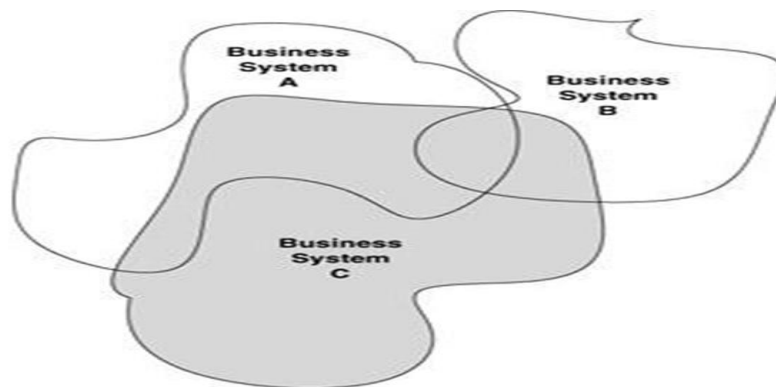
**Figure 1: A business model is a simplified view of a business.**

A business model is an abstraction of how a business functions. Its details differ according to the perspective of the person creating the model, each of whom will naturally have a slightly different viewpoint of the goals and visions of the business, including its efficiency and the various elements that are acting in concert within the business. This is normal, and the business model will not completely resolve these differences. What the business model will do is provide a simplified view of the business structure that will act as the basis for communication, improvements, or innovations, and define the information systems requirements that are necessary to support the business.

## 2.1 Business Concepts

A business, an enterprise, is a complex system that has a specific purpose or goal. All the functions of the business interact to achieve this goal. The business system in addition can be interlinked with and influenced by the decisions and events that occur in other systems, where can't be separately analyzed. This leads to difficult defining the boundaries of the business. The organization's resources can have separate goals that

do not forever reflect those of the business [1]. The most important elements in a business, namely, customers, suppliers, laws, and regulations are outside of the business and are not defined within the business itself. Therefore, the business system is an open system whose objects and parts are often also parts of other business systems. As such, it cannot be viewed as a black box system, which is analyzed by looking only at the input to and output from the system, but as a system whose parts are visible, as shown in figure 2 [1].

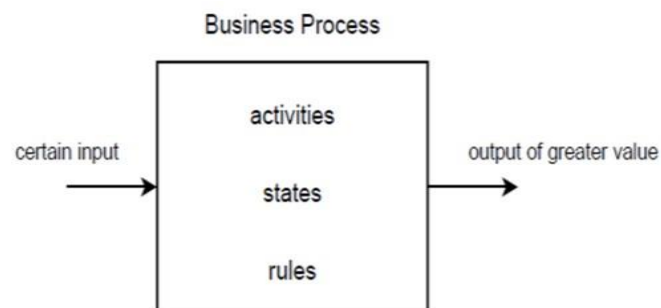


**Figure 2: A business system is interlinked with other business systems.**

## 2.2 Business Process

The business processes are the active part of the business. They describe the functions of the business, and involve resources that are used, transformed, or produced. It is an abstraction that shows the cooperation between resources and the transformation of resources in the business. It emphasizes how work is

performed, rather than describing the products or services that result from the process. A more formal definition of a business process is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. A business process has a goal and is affected by events occurring in the external world or in other processes. Figure 3 shows a general model of business processes [2].

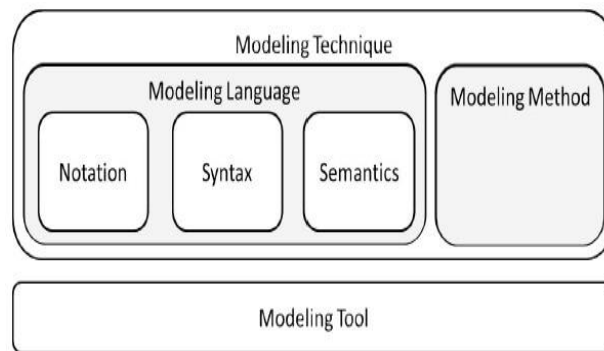


**Figure 3: A general model of business processes.**

## 2.3 Business Process Modeling Technique

Business process models are created based on a specific modeling technique. In practice several different techniques exist which are suitable for different business domains and purposes. For the creation of business process models, an appropriate technique must be chosen. Each technique consists of two major parts (figure 4), a modeling language (also called modeling grammar) and a modeling method. The modeling language can be further divided into notations (at least one), syntax, and semantics. The modeling notation defines graphical symbols that process modelers can use to model processes [4]. The syntax states rules for combining the symbols within business process models. For process modelers it is mandatory to stick to the rules specified by the syntax. The semantic

description binds a meaning to each graphical symbol to clarify its specific use. The modeling method defines the procedures which can be applied to create a business process model. Following these procedures ensures that the resulting model is compliant to the modeling notations used. In practice, modeling tools play an important role as they are used to create, maintain, and apply business process models.



**Figure 4: Components of a modeling technique.**

## 2.4 Business Process Modeling Tool

Business process modeling plays an essential role in the business process management regulations. For the last twenty years several methods and tools have been proposed to model a business process [5, 8, 11]. In this section, we present a brief survey of most of these tools including flowcharts, Petri nets, Role Activity Diagrams, Event-driven Process Chain, Integrated Definition for Function Modeling, and Business Process Modeling Notations.

### **2.4.1 Flowcharts**

A flowchart is a diagram that represents a process as a chain of activities and decisions. Flowcharts are the first and most fundamental process related to modeling methodology, their first use back to the early twenties, where they were used in by mechanical engineers to illustrate machine behavior. Basic flowchart entities are activities, decisions, start and end points.

### **2.4.2 Petri nets**

A Petri net is a formal modeling language that describes the behavior of simultaneous processes. Carl Adam Petri presented the graphical notations of Petri nets in 1939 [6], initially they were used to describe chemical processes. Compared to other methodologies, Petri nets provide a well-defined mathematical, this makes that all well-formed Petri nets can be construed and executed by a machine. While most other methodologies focus on representing the structure of a process, Petri nets focus on the actual behavior of a process. Furthermore, the mathematical basis of Petri nets makes them appropriate for different kinds of automated analysis [6].

### **2.4.3 Role Activity Diagrams**

A Role Activity Diagram (RAD) is a business process modeling methodology presented by Praxis Plc to model and analyse business processes [7] RAD is similar to UML activity diagrams, but there main difference is that RAD emphasizes on responsibilities, while UML activity diagrams emphasizes on orchestrating the activities [13].



### **2.4.4 Event-driven Process Chains**

An Event-driven Process Chain (EPC) is a business process modeling technique designed to produce business understandable models. It was developed in 1992 by August-Wilhelm and it has grown to become one of the most common business process modeling methodology. Its focus on logical connectors and functions make it appears, technically oriented, while it is in fact helps the business stakeholders, rather than the IT stakeholders [9].

### **2.4.5 Integrated Definition for Functional Modeling**

Integrated Definition for Functional Modeling (IDEF) is defined as a series of modeling languages initially designed to be used in the field of software engineering. The first IDEF modeling language created in 1975 as a side-product of the Integrated Computer-Aided Manufacturing program of the United States Air Force [10]. Since then, the IDEF group has grown to a set of 16 modeling languages. However, only the first five IDEF languages have matured into well-accepted modeling languages, while the rest were never developed any further than their initial definition.

### **2.4.6 Business Process Modeling Notation**

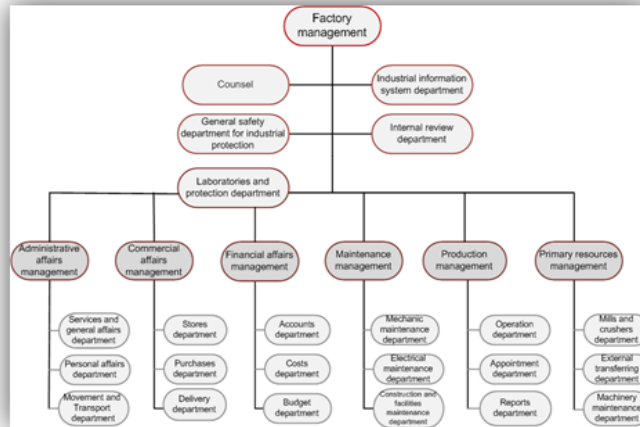
Business Process Modeling Notation (BPMN) is a methodology of business process modeling intended to provide human-clear representations of business processes [11,12]. The original version of BPMN was developed by the Business Process Management Initiative (BPMI) in 2004, but the Object Modeling Group (OMG) adopted the language as a standard for business process modeling in 2006 [15]. Five years later, BPMN became the most common notation for modeling business processes.

### **3. UML as a BPM tool**

UML (Unified Modeling Language) is a standard language for modeling, visualizing, constructing, and documenting the artifacts of software systems. UML was created by the Object Management Group (OMG) and UML 1.0 specification draft was proposed to the OMG in January 1997 [13]. It was initially started to capture the behavior of complex software and non-software system and now it has become a de-facto standard for modeling software systems. Although UML is used for non-software systems, the emphasis is on modeling software applications (especially object oriented software applications). It provides different diagrams that can be used to model the static and the dynamic behavior of systems. With its diverse number of diagrams, we think that UML can be used as a BPM tool. For this task, we chose use case diagram, activity diagram, and sequence diagram since these three diagrams. Throughout this work we use an inventory control system of the ELMERGAB cement factory as a case study to show how UML can be used to model a business process.

#### **3.1 Organizational chart of ELMERGAB cement factory**

ELMERGAB cement factory is one of a cement factories owned and administrated by the Al- Arabiya Company of cement. It is located in the town of Alkhoms and provides regular construction cement for local market. Figure 5 shows the organizational chart of company.



**Figure 5: Organizational chart of ELMERGAB Company**

In our study, we took the inventory control system of the company as our case study. First we defined the main business processes of the system, which are:

- Materials request.
- Internal purchase request.
- External purchase request.
- Materials receive.
- Returning materials or Discount on purchase
- Examining materials.
- Adding materials.

Next, we used UML to model these business processes with different UML diagrams.

### 3.2 Modeling the business processes of the system using UML

To model the business process of the studied system we used the following UML diagrams: use case diagram to define the system procedures, activity diagram to model the dynamic behavior of the system, and sequence diagram to express the activities of the system in terms of data messages.

#### 3.2.1 Defining the system procedures with uses case diagrams

Use Case diagram is a set of tasks, subtasks, and a set of participants. For the studied system, we defined the following procedures: request materials, internal purchase request, and external purchase request, receive materials, and communicate with the suppliers. Figures 6, 7, 8, 9 show the uses case diagrams of the procedures respectively

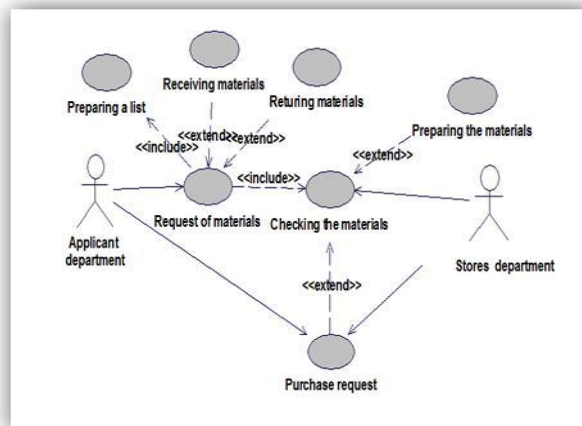


Figure 6: Use case diagram of request materials

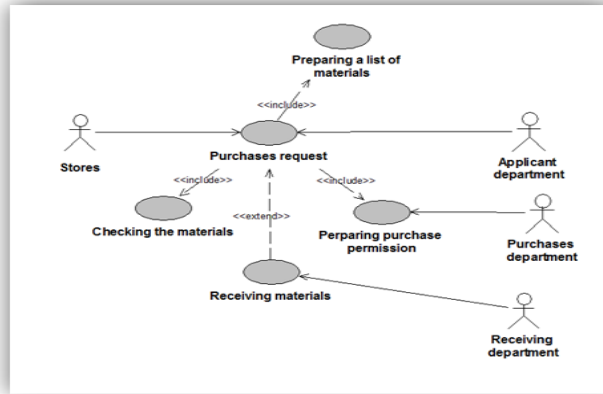


Figure 7: Use case diagram of internal request.

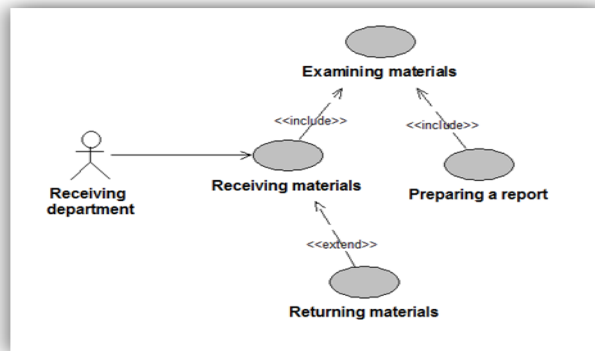


Figure 8: Use case diagram of receive materials

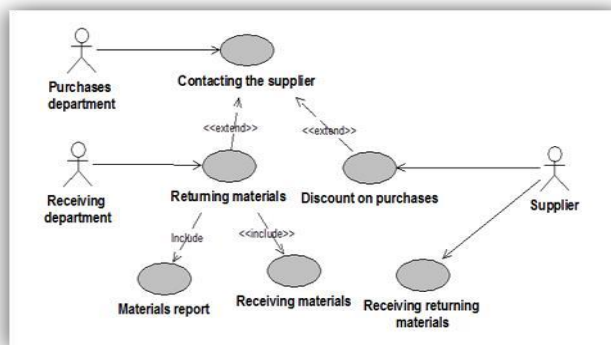


Figure 9: Communicate with the suppliers

### 3.2.2 Modeling dynamic behavior of the system with activity diagrams

Activity diagrams show the dynamic behavior of a system. They present certain activities that a group of objects conduct and explain the way in which a number of events and decisions happen in a sequence via a number of activities [13]. Activity diagrams are oriented towards the functional and informational perspectives of the business process [14]. The business processes of the system are represented by a set activity diagrams, as shown in figures 11, 12, 13, 14, 15, 16, 17. For instance, figure 10 represents the activity diagram of the process “request material”. The first activity in the process is issuing a request, followed by exchange of materials with exchange permission, next checking the materials. After that, we have two branches in the workflow, one if the materials are accepted in case of match and the other one if the materials are not accepted because of non-match, which leads the flow to another activity process, i.e. return materials and the activities workflow continue. The activities continue to flow in accordance with the processes of the system. The activity diagrams focus on how the work is performed and what information entities are created.



**Figure 10: Activity diagram of request materials.**

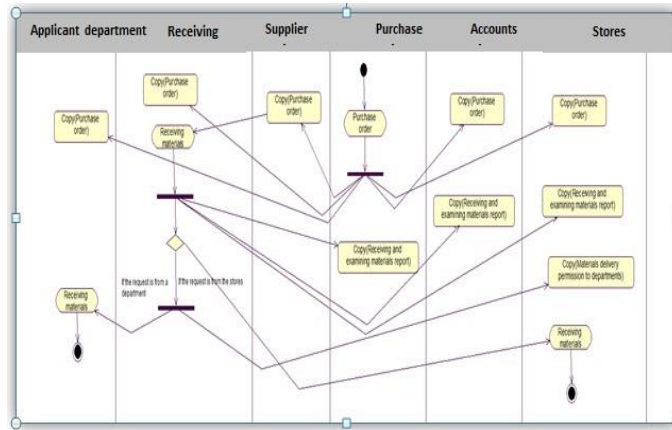


Figure 11: Activity diagram of request internal purchase.

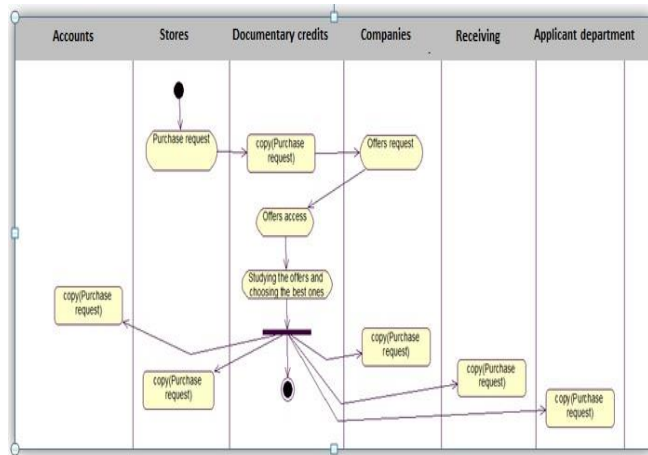
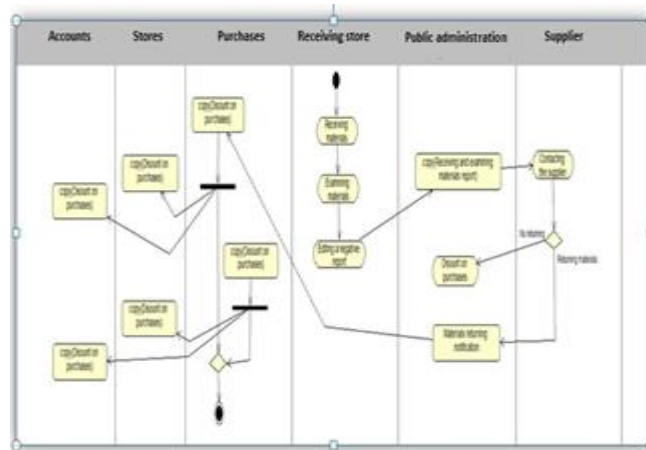


Figure 12: Activity diagram of external purchase request.







**Figure 15: Activity diagram of returning materials, and discount on purchase**

### 3.2.3 Sequence diagram as a BPM

Sequence diagrams illustrate the order of flowing of the data messages in a system according time order [13]. They describe how objects collaborate over the process step in time and meet the requirements of the behavioral perspective.

The business processes of our case study system are represented using sequence diagrams as shown in figures 18, 19, 20, 21, 22, and 23. Figure 18, for example, shows the sequence diagram of the process “request materials”. The diagram displays the chronological order of the processes that take place in the process “request materials”.

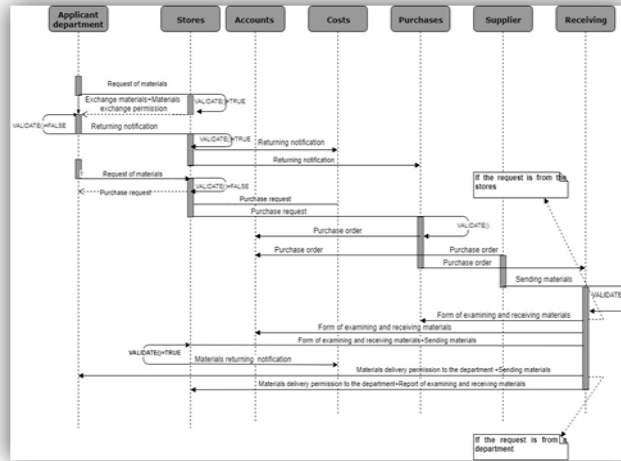


Figure 16: Sequence diagram of request materials.

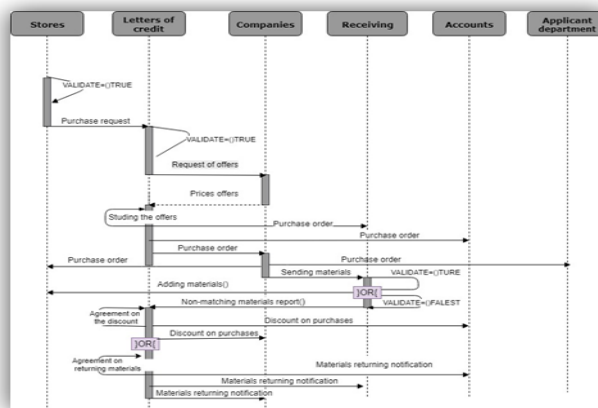


Figure 17: Sequence diagram request purchase.

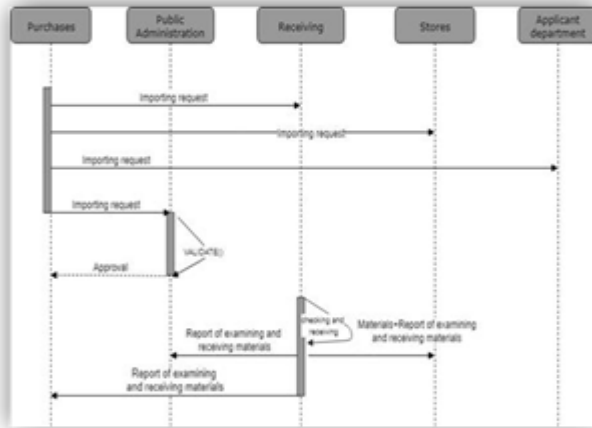


Figure 18: Sequence diagram of external request.

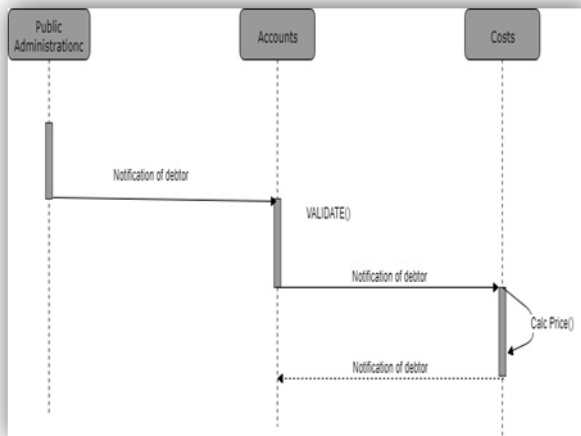
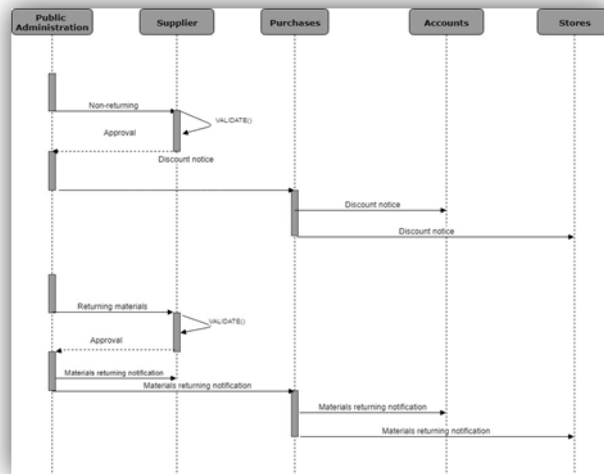
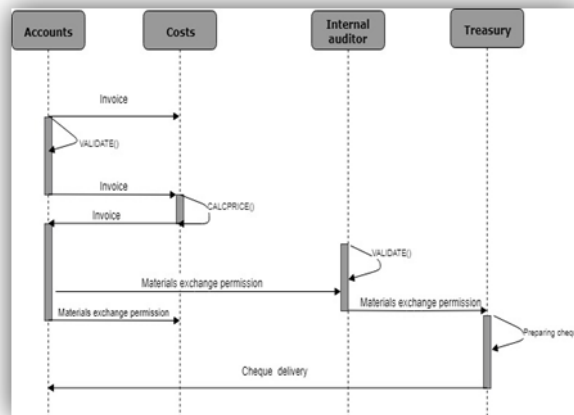


Figure 19: Sequence diagram of notification of debtor.



**Figure 20: Sequence diagram of returning materials**



**Figure 21: Sequence diagram of invoice and cheque preparing**

## 4. Conclusion

In this paper, we explored the stability of using UML as a Business Process Modeling tool (BPM). BPM is a critical component of any business improvement process; it allows capturing a broad outline and procedures that govern what it is a business does. We showed that different diagrams of UML, such as use case diagram, activity diagram and sequence diagram, can be used to model the business process of any case. By using UML as a BPM tool, one can profit from the advantages of UML including: its popularity in the industrial community as well as in the academic community, its standardization by a met- model governed by an international research group (OMG: Object Modeling Group), and its rich modeling tool with different visual diagrams and notations. A case study was presented to better understand how UML can be used as a BPM tool.

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