4. USE OF OBJECT ORIENTED METHODOLOGY IN BPR

4.1 INTRODUCTION

Object Oriented analysis provides sound framework for software design & development [T.DeMarco (73)][Robert (74)][Scott (75)]. Unified Modelling Language (UML) is the standard tool for analysis under Object Oriented methodology where all templates are standard.

The powerful analysis capability of UML [Craig (76)][Desmond (77)] can be extended for Business analysis. Behaviour [F.P.Brook (78)][B.Ratcliffe (79)], interaction & processes of the organization can be mapped using UML.

Following paras will further explain the different aspects & use of Object Oriented Technology in the field of Business Process Re-engineering.

4.2 NEED FOR THE NEW APPROACH

A business is a complex system, consists of hierarchical organization structure of departments & functions. Some of these functions are not restricted to one department, they cross horizontally across several departments. Traditional method for documenting a business is to draw an organization chart, which divides organization into several departments, or sections link sales, production, marketing etc. This documentation standard is limited to how the business is built & organizes. It does not talk about the business process, which flow across departments & affect vertical organization structure. This method of documentation fails to explain other structures in the business, such as business process, resource, and business rules, business goals.

Steps for any successful business re-engineering is to understand all components of the business, understand industry best practices & recommend changes only after ascertaining the risk & benefit.
Object Oriented-modelling approach using UML (Unified Modelling Language) [Rainer (80)] [Martin (81)] [Kendall (82)] can be an effective tool for business process modelling. The purpose of business modelling is to generate description (abstraction) of a complex reality that captures the core functions of the business. Ideally, a business model would consist of a single diagram that included all the important aspects of the business. However that is not possible because is a very complex process & all aspects cannot be shown in one diagram. Hence business model is composed of following:

4.2.1 Views:

A business model illustrates number of different views, each of which captures information about one or more specific aspects of the business. A view is an abstraction from a specific view points, it omits the details, which are irrelevant from that view point.

4.2.2 Diagrams:

Each view consists of a number of diagrams, each of which shows a specific part of the business structure or a specific business situation. Several diagrams are necessary to understand a single view of a business model. Each diagram has a different purpose & expresses one important aspect or mechanism within the business.

4.2.3 Objects & Processes:

Concepts are related in the diagrams through the use of different objects & processes. The objects are "things" in the business; they may be physical such as people, machines, products, & material or more abstract, such as debts, instructions, services etc. Processes are the functions in the business that consume, refine or use objects to affect or produce other objects.
Since its introduction in November 1997, the Unified Modelling Language (UML) has quickly become the industry standard modelling language for software development. Eriksson-Penkar Business extension [Rainer (80)][Hans-Erik (83)][Bruce (84)][Sinan (85)] of UML provides the symbols for the modelling processes, resources, rules & business goals.

4.3 ADVANTAGES OF BUSINESS MODELLING USING OO APPROACH

Similar Concepts

A business can be described in terms of processes that achieve goals by collaborating with different types of resource objects [Eriksson-Penker (98)]. Rules define conditions & constrains as how the processes & resources may relate to each other & how they may behave. All these can be mapped onto objects, relationship between the objects & interaction between objects.

Well-Proven Establish Technique

Object-oriented modelling & programming has been used for several years now & has proven that it can handle large & complex systems.

Standard Notation

Standard notations are essential feature for any modelling technique. Object-oriented modelling technique has finally standardized on UML. Use of UML for Business modelling will help to improve understanding of business across the globe.

Short Learning Curve

It is a major advantage when the same basic concepts (Objects, Classes etc) used to describe information systems that support the business can also be used to describe the
business as a whole. Use of this technique will help to reduce the gap between the information modeller & business modeller.

**Picture of Organization & Business:**

The traditional way of describing business & viewing organization does not show much of how business is performed. Object-oriented approach can easily show the processes as well as traditional organization structure.
4.4 CONCEPTS OF BUSINESS MODELLING USING UML

Main useful diagrams of Unified Modelling Language (UML) are as follows:

4.4.1 Class Diagram:

Class Diagram describes the structure of a system. The structures are built from classes & relationships. The classes can represent & structure information, products, documentation & organizations.

Systems are built from Objects, which can be physical, such as computer, people, raw material etc or abstract, such as information, knowledge etc. Objects are described by their internal properties & their relationships to other object.

A class is a set of objects with same characteristics. Typically classes are Person, Company, Supplier, and Order etc.
Classes are moderated & related to each other in a class diagram. The classes are described with names, attributes & operations. The relationship between the classes are described with a name roles & multiplicity. Figure 3 explains the Class Diagram for ABC Software Development Company.

ABC Software Development Company

![Class Diagram]

Figure 3 : [High-Level Project Class Diagram]

4.4.2 Object Diagram :

Object diagram expresses possible object combinations of a specific class diagram. It explains & illustrates class diagrams. This is a picture of objects & their relationship at a specific moment of time. As shown in the Figure 4, Object diagrams are drawn with objects & links. Multiplicities are not shown in this diagram, as this is a snap short. Corresponding class names are shown in Object diagram.
4.4.3 Statechart Diagram:

This diagram shows the possible state of a class. It is result of the attribute's value & links to other objects. It specifies how the object reacts to events occurring around it. Statechart diagram capture the life cycle of the object, subsystems & systems. It indicates what states an object can have & how different events affect those states over time. Statechart diagrams are drawn for classes that have clearly identifiable
states & complex behaviour. The diagram specifies the behaviour of an object & how that behaviour differs from state to state. As shown in the Figure 5, it also shows that which event changes the state of the objects of the class.

![Diagram of Order Processing](image)

Figure 5: [Change of Invoice Status by Payment]
4.4.4 Activity Diagram:

Activity diagrams are used to explore & describe a workflow, the actions performed in an operation in a class. This is similar to traditional program flowcharts. In addition Activity diagrams are used to describe business processes, work flows in context of organizations as shown in the Figure 6.

![Processing of Purchase Order Diagram]

Figure 6: [Activity Diagram]
4.4.5 Sequence Diagram:

Sequence diagrams are used to explore & visualize the sequence in which objects interact with each other. Typically, sequence diagram depicts the sequence of messages between a set of objects where the order & timing of the messages are clearly stated in Figure 7.

![Sequence Diagram for Order Processing]

Figure 7 : [Sequence Diagram for Order Processing]
4.4.6 Collaboration Diagram:

Collaboration diagrams focus on how objects collaborate, & express situations similar to those modelled by sequence diagram. Sequence diagrams handle sequences & simple selections while collaboration diagrams handle interactions. Collaboration diagrams make it easier to explain more complex interaction & show the relationship between the collaborating objects. Sequence diagrams are simple & easy to read but collaboration diagrams are more powerful & complex. Both are useful but in different situations as explained in Figure 8.

![Collaboration Diagram](image)

Figure 8: [Collaboration Diagram]
4.4.7 UseCase Diagram

Use-case diagram illustrates the relationships between use-cases. Each use-case, typically defined in plain text, describes the part of the total system functionally. This diagram summarizes which use-cases are available & their relationship with other use cases as shown in the Figure 9. Use cases & use-case diagrams are formulated in term of an actor & a system. An actor always has some interest in using the functionality the system provides. A use case is one use of the system by an actor.

![Use Case Diagram]

Figure 9: [Use Case Diagram for Project Management]
4.4.8 Component Diagram & Deployment Diagram:

Business Modelling does not use above two UML diagrams. These are required for software development only.

4.5 MODELLING THE BUSINESS ARCHITECTURE USING UML

Modelling a complex business requires the use of multiple views[Fowler (86)][Meyer (87)]. Each view focuses on a particular aspect of the business & is described through a number of diagrams sometime complemented with textual documents.

The Eriksson-Penkar Business extension [Hans-Erik (83)] of UML describes four main views of a Business as shown in the Figure 10.

![Business Vision Diagram](image-url)

Figure 10: [Business Vision]
4.5.1 Business Vision

This view describes the overall vision of the business. It states a goal structure for the company & illustrates problems that must be solved in order to reach those goals.

Figure 11 shows the generic model for Business Goal using Class Diagram.

Refer Table 4 for the critical factors that are generally considered for Business Views.

<table>
<thead>
<tr>
<th>Company Mission</th>
<th>The overall goal of the company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Specific goal.</td>
</tr>
<tr>
<td>Strengths</td>
<td>Specifies aspects at which business excels.</td>
</tr>
<tr>
<td>Weakness</td>
<td>Identify the area of improvements</td>
</tr>
<tr>
<td>Threats</td>
<td>External conditions</td>
</tr>
<tr>
<td>Critical Success Factors</td>
<td>Elements that are required for the growth of the Business</td>
</tr>
<tr>
<td>Strategies</td>
<td>Action plan that, if applied, will achieve the objectives.</td>
</tr>
<tr>
<td>Core Competencies</td>
<td>Areas of the business, which are most important</td>
</tr>
<tr>
<td>Roles</td>
<td>Specific functions of the people working in the business.</td>
</tr>
<tr>
<td>Organizational Units</td>
<td>Groups in which business divided.</td>
</tr>
<tr>
<td>Key processes</td>
<td>The key steps for success.</td>
</tr>
</tbody>
</table>

Table 4: [Business Vision]
Figure 11: [Business Vision : A Generic Model]
4.5.2 Business Process:

The view that represents the activities & value created in the business & illustrate the interaction between the processes & resources in order to achieve the goal of each process. Refer Figure 12 for clarification. This view also demonstrates the interaction between different processes.

Figure 12: [Business Process - A Generic Process Diagram]

The Business Process view described with an UML activity diagram. To use the activity diagram as process diagram, the Eriksson-Penker Business Extensions established a set of stereotypes that define a process & the various resources.
Process modelling creates an accurate documentation of the way in which work is performed. Process modelling also identifies new opportunities in the business & creates & designs new processes that take advantage of the resources & knowledge present in the organization. This is one of the most important diagrams for Business process-Re-engineering.

4.5.3 Business Structure:

The Business structure view shows the structures of the resources, the products or the services & the information in the Business including the traditional organization of the company (Division, Department, Section, unit etc.). It does not show the structure of the process or sub-process in the system.

The Organization charts & descriptions, & descriptions of the product & services are the basis of the Business Structure View. The UML diagrams used to document this view are Class & Object Diagrams. The Class diagrams show the principal structure & Object diagrams show an actual configuration of the class diagram. Figure 13 shows the look of an organization at a specific point of time.

![Business Structure View]

Figure 13: [Business Structure View]
4.5.4 Business Behaviour:

The Business Behaviour View describes the behaviour of individual resources or the interaction among either resources or processes. A resource is modelled with a UML statechart diagram through its states, the events that affect it & the actions it perform in a specific state. Or when it receives a specific event. Interactions are shown with UML dynamic diagrams line Sequence or Collaboration diagram.

![Figure 14: Business Behavior – A Generic Statechart Diagram](image-url)
4.5.5 Important Business Models/Diagrams

Eriksson-Penker's UML Business extension suggests following set of models/diagrams for modelling of a Business enterprise.

**Vision Statement Diagram** states the overall Vision. This Diagram is expressed in plain text.

**Conceptual model diagram** aims at defining the key business concepts. It is expressed as a class diagram.

**Goal Model** states the business goals & it is used for validation. Goal model is expressed in an Object Diagram.

**Process Diagram** shows the business processes & their collaboration. It is a specialization of the activity diagram.

**Use-Case Diagram** is a standard UML diagram that can be used to capture the functional aspects of the supporting systems. Functionality can also be described in plain text.

**Resource Model** captures the resources of a business, which can be information or things; the things can be either abstract of concrete. Concrete things include people, machine & abstracts things typically are organizational units, departments. Resource model is expressed in Class Diagram.

**Organization Model** shows the organization structure of a business. This is a special case of resource model. The Organization Model is expressed in class diagrams.
**Statechart Diagram**: This is a standard UML diagram. This is used to express the behaviour of a resource in a Business environment.

**Interaction Diagram**: This is used to conduct interaction analysis in a Business. This is expressed as standard UML sequence diagram or Collaboration diagram.

### 4.6 CONCLUSION

Eriksson-Penker's UML Business extension helps to analyse business scenarios under overall Object Oriented framework. An enterprise is a complex entity & all aspects cannot be explained using one set of diagram. Hence different diagrams are used to analyse/explain different Business scenarios. It is the responsibility of the Business analyst to choose the appropriate diagram.