Business Process Management – An Approach to Deploy the Web-Based Software

Nguyen Van Vy and Phan Thanh Duc

Abstract—This article presents an overview of how to develop the web-based software to solve the automation of business process. The development process of software in this way is nearly similar to the formalization method rather than the traditional approach with all the steps: analysis, design, programming, testing, and evolution. Thanks to the advancement of the graphic identity that after specifying a business process with a visual graphical model, we can compile automatically the specifications into the source code. The remaining task is to form the web-services for each module to perform a specific activity and install it in every position in this process. This approach allows us to manage the business processes, and can be quickly modified to suit the changing needs of the business activities of the organization or to restructure the existing business processes. On the other hand, the web-services can be reused for the different processes. These characteristics allow a rapid development of software, shorten the time and reduce costs significantly, particularly appropriate in an era where every business activity in the world require quick changes.

Index Terms—Business process management (BPM), business process (BP), business process modeling notation (BPMN), business process execution language (BPEL).

I. BUSINESS PROCESS AND PROBLEMS

Any action creating a product or a service is called a business process (BP). Thus, a BP will include a set of activities carried out by a certain sequence done by human or machines in various positions for processing the input, producing the output continuously to get the product or service in the last step.

For example, a cafeteria is making some cups of coffee when required. A BP here is shown in the Fig. 1:

![Fig. 1. Process for coffee making.](Image)

To solve the problems raised with the BP, the researchers have tried to define BP exactly, more completely, such as: business process is "a set of activities having one or many types of input with the aim to create the output for the customer" [1]. James F. Chang [2], defined BP by two points of view: In terms of system engineering, the process is a set of activities using inputs to produce results. In term of business, the process is a continuous range of activities done by human or machines to divide the departments, working place to achieve business goals, create internal values and satisfy the customer's requirements.

Two problems relating to BP:

Problem 1: The most common basic economic problem is always posed to BP at every age that is: how could BP create many quality products (productivity) with the least cost? In some specific cases, the problem may have fewer objectives, only one or two criteria (eg, the fastest, or quality and low cost).

Additionally, the following problem also relating to BP:

Problem 2: In terms of management, the BP is the knowledge of the organizations, or the enterprises. For a long time, a manager taking many years working in the organization can understand this knowledge. Therefore, the problem is that when necessary, how can give out immediately the BP description for use without making the material from the first step. The use here not only includes the knowledge in the activities of the organizations that a manager should know, but also includes the modification, and reuse of them. In the context of rapidly changing world, the professional activities of all organizations should change to adapt to changing environments, to meet the competitive requirements in the products, goods services. This urgent problem is posed not only because of the practical needs, but also including its economic content: that is, how to restructure the BP rapidly with as low cost as possible. This is the problem of Business Process Management (BPM) as the complex data.

II. SOLUTIONS TO THE PROBLEMS RELATING TO THE BP

Solving the first problem is to reduce the time of the entire process making the products and ensure their quality. It can be seen from the diagram that there are two kinds of typical activities of each process those are: "processing" impacting on the products and "movement" to move the products. Therefore, to achieve the set objectives, the four specific contents as follows should be solved:

1) How can the activity of "processing" of BP form the outputs fastest as possible, and with quality (the problem of activity specialization and automation)?
2) How can "movement" of inputs, intermediate products and final products fastest as possible? ie shortening the maximum movement time of the product formed between the processing activities of the BP, thereby shortening the time to operate the whole BP (the problem...
of transmission environment and means)?
3) How can the intermediate products be used repeatedly, ie, not wasting the time waiting (the problem of synchronization) for processing?
4) How to minimize all processing activities and movements on the process, ie only retaining the really necessary and reasonable activities and movements (the problem of process improvement and optimization)?

A. Evolutionary History of the Problems

Adam Smith (1723-1790) may be regarded as the first to have the solution to the first problem of BP. In his work: "The Wealth of Nations" [3], he introduced the idea of labor specialization. The labor specialization is the basis of the division of departments, industries, jobs by functions in the organizations today. Thanks to the labor specialization, the departments and individuals may do the tasks and improve the quality of their work, shorten the duration of BP which they participate in. This may be considered as the basis for the development of BPM later.

Taylor extended the concept of Adam on labor specialization by providing the scientific method and the measurement of production process presented in his book: "The Principles of Scientific Management" [4]. His theory was applied by Henry Ford in the Ford Company since 1913 to formulate the production and assembly lines, essentially they solved the four basic contents of the first problem on the basis of applying semi-automated and automated machines for processing and movement of the products used in the production in the industry.

As we can see, the basic solution to the first problem is automation. Nowadays, thanks to the development of control technology and automation, the automated auto assembly line is a typical result of solving thoroughly the first problem of PB in the industry. The assembly lines of industrial products help the productivity increase by hundreds of times with very high quality each year.

In a developed society, the services increasingly account for a large density in the national income (in the developed countries, this percentage is up to 60-70%). Thus, solving the first problem for the products and services (including information services in management, finance, banking...) has been paid particular attention to when IT is increasingly developing. Thanks to the basis for automatic information processing and transmission, the BP has created the information services that have been highly automated.

In the 1950s, the Total Quality Control (TQC) was launched by the leaders of General Electric. TQC was defined as a system of integrated processes to maintain, develop and improve the quality of many groups within the organization [5]. TQM was first applied in Japan, followed by Taiwan, Korea, and then gained its popularity in the U.S. since the 1970s. This method actually went on to solve both problems of BP mentioned above.

Recently, solving the problems of BP has been based on "Six Sigma" method. It is a business management strategy developed by Motorola in 1980 [6], and then was applied and popularized at General Electric in 1995, and it is widely used in the industry nowadays. The enterprises should create a system of processes, and identify, calculate the effective operation level for each process in their organizations. Nowadays, the systems of methods and tools have been developed completely [7] to support the implementation of "Six Sigma" in the organizations and enterprises.

The workflow in the management departments is an exchange process of documents between employees in a predetermined sequence. Those are the BP creating the information products. In the 1980s, IBM launched a software system known as FileNet which was used to solve the problems relating to the workflow. These systems focused on the main task were to process and exchange the paper documents into image files from the employee to the other through data storage and update system. This was an improvement as the enterprises, and the organizations began to implement the storage of digitalized documents with the purpose of sharing. Since then, the information technology (IT) has been used as a tool to manage the BP. [8], [9].

An important revolution solving the problems of BP took place in the 1990s, when many Western companies were facing with an economic downturn and strong competition in the context of globalization. The “Business Process Reengineering” (BPR) [8], [1] was set, that was the basis of the idea to the general problem of BPM. BPR is a strategy, solution to restructure, reorganize the operation ways of the business processes in order to achieve high efficiency in business operations and production in the new conditions.

BPM approach is considered to be the synchronization of all previous methods. BPM not only focuses on the processes of statistics, control, testing and management, but also focuses on solving the basic problems to improve and change the BP in the enterprises. BPM considers all management methods and implementation methods based on the achievements of IT in order to help the enterprises to understand, evaluate and change the ways they work effectively to meet the changes of the working environment nowadays.

B. BPM Method

BPM is a system approach includes the concepts, methods, tools and techniques to support the management, firstly to describe and analyze the BP, then to design, configure, and implement them. In his scientific works launched, Aalst defined: BPM is a method to support the management of the enterprises by using methods, techniques, and software to design, launch, control, and analyze the operation processes related to humans, organizations, applications, documents and other information sources. [10]

Professor Michael L. Tushman of Harvard University and Professor Mary Benner of Minnesota University also had a definition of BP: based on a view of an organization as a system of interlinked processes, involves concerted efforts to map, improve and adhere to organizational processes. [11]

In the BPM, the BP are both objectives and tools to organize operations in the enterprises and improve their relationship to create the scientific, unified, convenient and effective business processes. Through the management, improve and automate BP then the business owners can reduce management costs, improve customers’ satisfaction, develop new products and services in the shortest time with reasonable costs, and ultimately dominate the market with a
competitive advantage and increase the profitability.

Prof. Mathias Weske of University of Potsdam, launched a research of the objects interested in the field of BPM in his book: "Business process management, concepts, languages, architectures" [12]. He pointed out two main groups of objects interested in the field of BPM. One is the community of people working in business administration concerned about the use of BPM to improve the operation of the enterprises. The other is the community of people working in the IT sector concerned about the BPM in the different aspects of the methodology and technology. Researchers concerning about the methodology would like to model the BP when using the appropriate languages for the specification of the operations. Modeling shows us the visual models of the BP structure. It is useful in analyzing, completing the BP as well as using the tools to manage and automate it.

C. Ideas of BPM Method

With the process creating the information products, in term of principle we can apply the general method of software engineering to create software for a specific business process. The general diagram for software development is described in Fig. 2.

![Fig. 2. General life-cycle model to develop a software system.](image)

Based on the different orientations (structures, objects,...), developing a software system, the models and methods used in steps 1 and 2 is often composed of many types and very different [13]. The implementation of a software as this general model requires many efforts and the qualified and experienced developers, especially in the stage of analyzing, specifying the requirements (1) and design (2).

Due to the characteristics of BP and the advancement of graphic technology, one can specify the BP as it exists in the real world using the graphical notations. When analyzing and completing a BP, it is also considered as a design of BP. Thus, in the BPM methodology, analysis and design of BP is considered as one. The next step is to locate BP in its operating environment like locating a production line in the space. Because the environment where the BP operates is the web environment, so transferring the data from one address to another is simple. The remaining problem is to locate the direction of their movement. To do the processing activities, each activity in the process is done by a pre-established web-service "device". So we have automated the "line" of BP. The only remaining problem is to compile the designed processes into the execution languages. This task is done automatically by a software system: "compile and run": Business Process Execution Language (BPEL). The diagram of BP development process shown in Fig. 3

According to this diagram, the software development for the processes does not need programming, and testing. It resembles the formalization method: just specifying and verifying the correctness of the requirement specification to get software thanks to the compiler.

Comparing the two diagrams of the development process in Fig. 2 and Fig. 3, we can see that:
1) The diagram in Fig. 3 is simpler with the higher level of automation
2) The implementation of steps (1) and (2) of the diagram in Fig. 2 should use many different models and methods, so it is difficult and complicated. The implementation of steps (1) and (2) of the diagram in the Fig. 3 is much simpler, especially the professional managers and experts may participate directly in designing the process (because only works showing BP on the computer need IT experts). This is a remarkable advantage compared with the general software development method, in which the IT experts must take time to gather information and specify the requirements of the problems.

Due to the above advantages that implementing BPM applications is having a very large scale and developing multiply. The world market of BPM in 2007 reached $1 billion, and in 2011 the number is forecasted to reach $2.6 billion; IDG even evaluates much better compared with the number of $5.5 billion, and Forrester predicts up to $6.3 billion [14].

III. DEVELOPMENT LIFE-CYCLE MODEL OF BPM

The development lifecycle of BPM is a methodology to develop a BPM system. It involves many different fields, from the theory of BP to its operation practice, from IT to business management, from the business managers to the software developers and system integrators.

There are many studies on the development lifecycle of the BPM. However, most studies are consistent with the model of the development lifecycle by Aaslt. According to Aaslt, BPM development lifecycle includes the following stages [10] (Fig. 4):

![Fig. 4. Model of BPM development cycle by Wil van der Aalst [10].](image)

A. Stage 1: Design the Process

At this stage, the BP models will be composed, analyzed and completed, and updated into Business Process
Management System (BPMS). This stage involved the use of standards of graphic design and management system of the BP.

B. Stage 2: Configure the System

The stage 2 locates the BP in the operating environment, including the configuration of its specifications in the BPMS and the underlying systems. For example, synchronize the interactive role among the activities of the BP, connect each activity of the BP with the employees’ accounts and put into the Active Directory on the Server Windows.

C. Stage 3: Launch the Process

The models in the BPMS are used to run on the BPM servers to create the execution code. The software of Business Process Execution Language (BPEL) will compile the BP model designed by Business Process Management Notation (BPMN) for BP into BPEL and run on the BPMS servers.

D. Stage 4: Diagnose the Process

The environment in which the processes operate depends on the specific system configuration used: the capacity of servers and workstations, line bandwidth, outward aspect of network, the connection interfaces... Therefore, BPM experts should use the appropriate analytical and management tools to be able to identify errors or bottlenecks in the whole BP of the enterprises when it works from which recommend the necessary modifications and improvements to complete the BP and enhance the operational efficiency of the organizations.

IV. STANDARDS AND TOOLS

To be able to get the system of BPM development lifecycle, it is necessary to have the methods, the tools to do. Based on the BPM development lifecycle by Aalst, a recent study by the authors from the Nyanang University of Technology - Singapore [15] launched the classification of standards for BPM associated with development lifecycle (Fig. 5):  

<table>
<thead>
<tr>
<th>Graphic standards BPMN, UML, AD</th>
<th>Analysis standards BPRI, BPLQ</th>
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<tbody>
<tr>
<td>Data exchange standards XPD, BPDL</td>
<td></td>
</tr>
<tr>
<td>Execution standards BPEL, BPML, WSFL, XLANG</td>
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Stage of designing, launching the process Stage of analyzing

A group of authors from the Nyanang University of Technology - Singapore launched a study to classify BPM standards based on its functions and features. Generally, we can see that all BPM standards can be placed into one of four stages of the BPM development lifecycle mentioned above. For example, BPMN language supports the design process, while the BPEL language focuses on the launching process. There are also some languages such as: XPD and YAWL are designed to deal with both these processes, and it is difficult to put them into any single stage. For this reason, the authors divided the standards of two stages of Design and Launch in three groups as follows:

Group 1: The graphic standards: allow the users to represent the processes and dataflow in the chart appropriately.

Group 2: The execution standards: allow creating and executing automatically the BP designed.

Group 3: The exchange standards: allows the data to be shared and used conveniently.

For example, the charts of process are used independently from the BPMS basis and the compilation of the graphic language into the execution standards and vice versa.

The BPM packages often use the three groups of standard mentioned above. However, the preeminent features of the BPM is expressed through the diagnosed standards. The diagnosed standards provide the administration and management tools. These standards allow identifying the bottlenecks of the system, tracking and querying the business processes in the enterprises.

The diagram in the Fig. 6 shows the classification of the existing standards in the BPM standards according to application fields, as well as determining the standards of B2B systems and Web Service/SOA involved [16]. BPM is in the development stage, the diversity and heterogeneity of BPM development directions are obvious. Many different tools set by the large companies to assist the implementation of BPM as the tool software or BPM administration system [17]. For example, Intalio Designer, KAISHA - Tec ActiveModeler. So deploying BPM applications for the organizations and enterprises is becoming more and more convenient and efficient.

V. CONCLUSION

BPM is a new way to deploy IT applications for the BP of the organizations and enterprises. The deployment of BPM is not only bring benefits to applying technology, but also support to knowledge management in the enterprise in order to adjust processes quickly in response to changing market requirements in globalization nowadays. Although it has just been introduced for more than a decade, it has grown rapidly on the three sides of a technology development direction: methodology, methods and tools, and with many successful experiences. Due to the advantages of simplicity, ease of deployment compared with the traditional IT applications, it
has been applied efficiently popularly by many countries. It is time we should do the researches, teach and apply it to promote the performance of organizations and enterprises in the new conditions.

REFERENCES


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