Business Process Modelling Towards Derivation of Information Technology Goals

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Abstract

Business Process Modelling (BPM) is a way to support business processes by using several techniques, methodologies, models, and systems to design, control and analyse business processes, where many resources are used: humans, applications, technologies, organizations etc. The current existing literature describes several BPM techniques, however, these techniques are often hard for IT people to understand which is one of the reasons why IT is often unable to completely implement the desired business process. This paper aims to present a business process modelling framework that is easy for IT people to understand. A mobile phone order management process in a telecommunication company has been used as a case study to validate the proposed framework. The results indicate that: 1) BPM has a positive influence on the implementation of a system according to business expectations; 2) by considering IT at the time of BPM, this resulted in better cultural and social relationships between the business and IT staff.

Key words: Business process modelling; Information system; Business process; Case study.

1. Introduction

One of the major challenges of BPM is managing rapid changes in the business environment [1]. Hammer and Champy (1994) found that business environments can be affected by several forces, such as consumers assuming to be in the operation department of the company instead of the salesmen and strong competition with other similar firms, resulting in companies changing their business goals rapidly. Consequently, the business processes suffers [2]. BPM is an important aspect of managing business processes within companies. It provides support to the organization’s processes by using different methods, techniques and software tools to control and analyse the organizational processes and activities, which includes people, organizations, applications, documents and other related information [3], [4]. Moreover, a well defined BPM method improves business performance by clarifying the business process including company goals, objectives, policies, and strategies [5, 6].

There are many business process modelling standards, languages, techniques, and tools in the literature, such as the Business Process Modelling Notation (BPMN) [7], Unified Modelling Language (UML) [8], Business Process Execution Language (BPEL) [9], etc. Some of the various techniques include the classification of modelling the business process [10], modelling languages for the process [11], task-based methods to construct the business model [12], modelling the process for information system design [13], etc. However, these techniques are hard for IT people to understand, which is often the reason why IT is not always able to completely implement the desired business process.

This paper aims to present a business process modelling framework that can be easily understood by IT people. We have divided our proposed framework into two modelling environments: the business modelling environment and the Information Technology modelling environment. A mobile phone order management process in a telecommunication company has been used as a case study in order to validate our proposed framework. The results show that BPM can have a positive influence on system implementation according to business expectations, as well as have a positive influence on the social and cultural relationship between IT and business staff in the organization. The remainder of this paper is organized as follows: section II describes the background of BPM; section III presents our proposed framework; section IV describes the proposed framework validation with the help of a case study; and the conclusion and future research directions are presented in section V.
2. Background

The notion of business process management is not new; it has been studied for many years. For example, in 1776, Adam Smith proposed the idea of managing labour in the manufacturing industry. He argued that a process could be divided into several sub-parts in order to make it more efficient [14]. Frederick Taylor (1911) proposed a management method known as 'time and motion' to document and analyse the work involved in business processes in order to reduce the time and the number of functions involved in any process. Proponents of the time and motion method claim that as a result of implementing this, there was an overall improvement in employees’ efficiency and the quality of the end product [15].

This concept of managing business and business activities expanded over time, and researchers began to use different terms to refer to this. In the 1960s, the term BPM was first used in the field of system engineering by S. Williams [16]. The idea of his approach was to cope with business process management issues, which helps companies produce a large volume of goods in less time, as in the 1960s, companies were aiming to increase their production in order to meet consumer demands [17]. In the 1970s, researchers introduced the concept of managing business processes automatically and proposed many techniques such as: workflow technologies, transaction process systems and manufacturing automation. In the early 1980s, the Total Quality Management (TQM) concept was introduced with several ideas, such as lean manufacturing and Six Sigma that were proposed in order to produce higher quality products with more services for a lower cost in less time [18]. The key features of TQM are that it is mainstreamed and can be successfully adapted to suit business processes in the 2000s.

In the 1990s, Business Process Reengineering (BPR) was proposed by Michael Hammer [19]. BPR aims to improve the critical measures of business performance by using IT services in order to fundamentally rethink and redesign business processes [20]. There are several tools and techniques used in BPR, such as process visualisation, process mapping/operation, change management, benchmarking and process and customers focus [21].

In the 21st century, business process management is considered to support different aspects of business processes in and between organizations, such as advanced reporting and analysis methodologies, executing business processes with workflow management, business process quality assurance and optimizing and redesigning business processes. Furthermore, companies aim to provide more high quality services in the 21st century. BPM allows organizations to abstract business processes from IT innovations as well as enabling them to modify their own business processes quickly, according to their changing requirements and customers [14].

As a result, the literature today describes many business process modelling techniques [10-13, 22-26]. For example, Aguilarsaven proposed a framework to classify different BPM standards and techniques according to their change model permissiveness and purposes [10]. Zur and Indulska used the Bung-Wand-Weber (BWW) representation in order to compare the representation capabilities for the rule and process modelling language [11]. Shi et al. proposed a Task-Based modelling (TBM) method which defines the key verb as the basic task components in business processes in order to model processes in a construction business [12]. Barjis’ aim was to design a BPM-based transaction theory of the DEMO method and the Petri net formal semantic graphic [13]. However, these techniques have several drawbacks and limitations, the most serious being that they are difficult for IT people to understand, which is often the reason why IT is unable to completely implement the desired business process.

In other words, it is hard for IT analysts to understand the business process and that is the reason why they always feel difficulties in order to develop the information system according to the proposed business process or according to the business expectations. As the process is a complex element of the business, one business process can carry more than one sub-processes or business goals. Therefore, business process modelling is an important priority to develop the process. This paper aims to present a business process modelling approach to model the process priority to implement the process [27].

3. Proposed Framework

BPM is a well accepted method within the business organization sector for structuring business processes. It provides support to the organization’s processes using different methods, techniques and software tools to control and analyse organizational processes and activities, which includes people, organizations, applications, documents and other related information. A successful BPM method contains three important components: model, strategy, and operations. A business model includes knowledge of the creation of the organization,
delivers values, and how to capture the business goals and objectives. Strategies carry rules and guidelines that fulfil all model-related elements. Operations in the business are the combination of several elements, such as people, processes and technology, whereas a different group of people worked together to complete organizational required goals with the help of information system services.

We have categorized our proposed framework into three separate parts: the business decision level, the business process modelling level and the Information Technology system goals level, where each level is made up of four business components as shown in figure 1. The business decision level consists of the business goals, the business rules, the rules measurement and the business rules analysis. The business goals are used to specify what the organizations need to achieve and when. The business rules aim to describe the operations and constraints which apply to the organization. The rules measurement is used to model and define business rules. The business rules analysis is used to assist the organizations to organize their business rules so that rules, including errors, can be identified [27].

The business process modelling level consists of the role model, the process events, the decision model and process monitoring. The role model is a technique to define the business goals. Process event is used to identify the detailed activities of the proposed process to be studied. The decision model is a model to manage and organize the business rules and logic. Process monitoring is a technique to track every individual process within the organization. The information system goals consist of the system behaviour, the business process, the system behaviour analysis, and the use case. System behaviour describes how process activities react. The business process is a set of activities acquiring one or more inputs and generating output as a value to the consumers. The system behaviour analysis is used to identify any missing information or errors in the process. The use case identifies the interaction between the system and the external actors in order to effectively achieve the business goals and objectives.

3.1. Modelling Business Environment

The modelling business environment contains two parts: the business decision and the business process modelling.

Figure 1: Proposed BPM Framework.
3.1.1. Modelling business decision

Modelling business decisions consist of the business goals, the business rules, the rules measurement and the business rules analysis. Business goals are used to represent why business processes exist and how to fulfill the organization’s mission statement. Business rules refer to the statement that how to control the overall business behaviour. It defines the operations, business constraints and definitions that apply to an organization. The business rules could be applied to people, business processes, behaviour and the information system in the organization and are put in place in order to assist organizations achieve their goals and objectives [11]. The measurement of business rules depicts the detailed analysis of business rules. Business rule analysis is a procedure to define rules and refine their meaning.

3.1.2. Business Process Modelling

Business process modelling consists of the role model, the process events, the decision model and the process monitoring. The business role model is used to capture the business organizational value. Events in the process are things in the business that affect the sequence of the process, including activities. The decision model is a unique logical representation for business logic showing how and where it is executed. Business logic, which is the logic proposed by the business rules, represents how the business intends to make significant decisions. The decision model is used to perceive, manage and organize the business rules and logic. Business process monitoring is a method used to identify how business people can provide real-time information on the significant indicators of the business performance in order to improve the speed and effectiveness of business operations. In the process monitoring, each individual activity is tracked and thus information on the state of the process can easily be seen and statistics on the performance of the process can be presented.

In this proposed paper, we model business decisions and business processes using well accepted modelling techniques, namely F* and the UML goal tree, as shown in figure 2 and figure 3.

3.2. Modelling IT environment

The term “IT modelling environment” became popular in the mid 1990s and refers to a set of shared IT resources that work together to achieve common goals. The IT environment normally comprises two major parts: “technical” and “human”, where technical includes software, hardware, network, telecommunication, etc, and human refers to the technical skills (persons) and knowledge that is required to maintain the IT resources. In the context of organizations, business processes are increasingly becoming more and more complex every day and their goals and objectives are changing rapidly. In this situation, the IT environment needs to be flexible so that rapid changes in business goals and objectives can be managed. In this paper, we propose to model the IT environment in relation to four different components: system behaviour, the business process, system behaviour analysis and use case.

System behaviour refers to how the system should behave when the customer places a query. The business process is a set of internal organizational procedures or activities that work together to achieve an organization’s goals and objectives to meet the consumers’ expectations. It is the key element of the business where other business components, such as goals, strategies, policies etc are based. System behaviour analysis is used to identify errors in the system’s behaviour; for example are all the system’s functions working well or not? Use Case Analysis is a technique used to identify the high level requirements of a system. We begin by identifying the actors involved in using the system. We then identify all the functions each actor will be performing with the system. Each function an actor is intended to carry out with the system is a use case. Two important elements are necessary for a complete use case diagram: actor and use case, where an actor is a person, system or other external entity that interacts with the system in question and a use case is a description of a system’s intended behaviour, given an external request by an actor. A use case identifies the type of interaction with a system and the actor involved. Use cases are a fundamental feature of the UML notation for describing system models.

4. Case Study

To validate this proposed framework, a mobile phone order management process in a telecommunication company is used as a case study, where the company goal is to implement the process of registering a new customer automatically in order to save customer time and reduce the number of staff which will, in turn, have a positive effect on company
Revenue. The modelling language has been used to model the proposed business model.

The modelling framework is an agent-oriented requirements modelling language appropriate for the early phase of system modelling to understand the system’s problems. It is used for the strategic actor relationships and intentional model. This framework contains two important components: the Strategic Dependency Model (SDM) and the Strategic Rationale Model (SRM). The SDM is used to describe the network of the relationships between actors. Moreover, the SDM is a component where every node represents an actor and every link between two nodes shows that one actor is dependent on the other actor. It provides a description for the external relationships between the actors. The aim of the SDM component is to provide indications about why the business process is organized in a certain way. However, it cannot adequately support the exploration, suggestion and evaluation of other solutions for the process, which the SRM can do.

Figure 2: Telecommunication Company Process

Legend

Resource Gateway Start activity
End activity Association Flow
Order shipped Packet complete
Packet ready to ship
The SRM is used to support and describe why the actors can have different ways to organize their work, such as a different configuration for Strategic Dependency networks. Moreover, SRM has four main nodes: goal, soft goal, resource and task, and two main links which are mean-ends link and the task decomposition links. It is used to model the internal relationships between actors. This model can systematically explore the area of possible new business process designs [28, 29].

Figure 2 shows how we model the proposed business process using I*. The model starts when the customer completes an online application form to order a new mobile phone and connection. After the company’s head office receives the form, they then check the information provided by the customer; if the information meets the company’s requirements, then the order is forwarded to the operational department. At this stage, the operational department creates a temporary packet which includes the order notes and sends it to the warehouse staff. The warehouse staffs are responsible for checking the availability of the mobile. If the mobile is in stock in the warehouse, they complete the packet and send the packet for shipment. However, if the mobile is not in stock, they hold the process and wait for new stock to arrive.

Figure 3: Goal Tree Model
Once the process has been modelled, then there is a need to analyse the process. As the process detailed in figure 2 only shows the business point of view, it is hard for IT people to understand the business process completely due to their lack of business knowledge. Therefore, we introduce the goal tree to analyse the process. A UML goal tree is used to analyse the mobile phone order management process, as shown in figure 3. A goal tree consists of different sets of nodes that are used to illustrate the goal. The nodes could be an operator, goal or test group nodes. The operator nodes are either a logic AND & OR operators [30, 31].

The analysis method is categorized into three main functions: (1) the place order function which is made up of three sub-process activities: “order to be processed”, “modify list” and “packet final”; (2) the mobile company system function which consists of “receive order” and “order shipped” activities; and (3) the packet ready to ship function contains two process activities: “packet complete” and “order shipped” and five sub-functions: complete packet, mobile availability, check when complete (“empty box”, “mobile” and “delivery note”), check when not complete (“wait for stock” and “delivery note”) and place delivery note in packet (“prioritise delivery notes” and “delivery notes placed”) functions.

After the process has been analysed, we then read the process in figure 3 thoroughly and identify the activities and functions which can be automated and those which are manual. Figure 4 shows the automatic and manual functions and sub-functions in our case study, where Symbol refers to automatic functions and refers to manual functions, sub-functions, and activities. There are 18 automatic functions, sub-functions and activities in

![Figure 4: Automatic and Manual Function of Goal Tree Model.](image)
our case study process. However, there are 3 manual activities which are empty box, mobile, and wait for stock.

At this stage, the process is completed and analysed and is ready to derive the systems goals in the form of a UML use case. The use case is a graphical description of the actions or steps involved in the business process between the users and the software engineers system used. The UML modeling behavioural diagram is used to assist IT people develop and determine the implemented features and how to resolve the errors. Use cases help to obtain the system goals, such as: what needs to be included in the proposed mobile phone order management process (demand)?; where the process is going to be used (location)? who the process stakeholders are (users)?; and what are the company’s deadlines? After obtaining this information, it is then easy for IT developers to implement the process.

Figure 5 shows two use case diagrams for our case study. The first use case contains one actor, namely process start and four use cases which include “create the package”, “add delivery notes”, “confirm delivery notes” and “sort order”. The second use case contains five actors: the customer, head office, general manager, store manager and company staff. The customer actor logs on to start the order and then head office manages the customer order. Next, the store manager actor adds the notes. The general manager actor modifies the package, confirms this modification and makes the mobile shipment after the company staff actor checks the notes. By using the use case model, the system goals according to business expectations are now clear, allowing IT developers to develop the system easily.

5. Conclusion & implications

In this paper, we have proposed a business process modelling framework for IT people to better understand the business process. It contains three levels: the business decision level, the business process modelling level, and the Information Technology system goals level. The framework was validated by using the case study of mobile phone order management process in a telecommunication company. The results indicate: (1) the modelling business process has a positive influence on obtaining the systems’ goals; and (2) that this enables IT developers to implement the system according to the business’ desires, which alternately positively influences social and cultural relationships between business and IT staff.

Two major implications can be derived from the study for information system developers and business organizations. First, for developers, the study shows how system goals can be derived from the business environment which leads them to better understand the business’ demands. Second, for the business

![Figure 5: Use Case Model](image-url)
organization, it is always hard for business analysts to define business goals and objectives. This proposed framework enables business analysts to identify and analyze business goals and objectives. However, the paper has one limitation; we only tested our proposed framework on one business process. Thus, in the future, it could be possible to test our framework with more than one business process in different business sectors by using different modeling techniques, such as BPMN or ARIS etc.

References