SIMULATION MODELLING: EVALUATION OF INTERNET BUSINESS MODELS

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Abstract

It is apparent that developing dynamic models of business processes prior to their radical change could increase the success of BPR projects. Simulation has an important role in modelling and analysing the activities in introducing BPR since it enables quantitative estimations of influence of the redesigned process on system performances. The main goal of this paper is to investigate some of the potential benefits and outcomes of introducing new or redesigning existing processes that could be assessed in advance by using simulation modelling.

1 Introduction

E-business dramatically and strategically changes traditional business models. Companies are now pursuing more intensive and interactive relationships with their business partners: suppliers and customers. Competitive conditions and pressures on global market are forcing companies to search for strategies of streamlining the entire value chain. To compete effectively, companies must structurally transform its internal and external processes. These goals could be reached by simultaneous renovation of business processes and implementation of electronic business solutions.

Business Process Reengineering (BPR) is an organizational method demanding radical redesign of business processes in order to achieve more efficiency, better quality and more competitive production [6]. BPR has become one of the most popular topics in organisational management creating new ways of doing business [13]. Many leading organisations have conducted BPR in order to improve productivity and gain competitive advantage. However, regardless of the number of companies involved in re-engineering, the rate of success of re-engineering projects is less than 50% [6]. Some of the frequently mentioned problems related to BPR include the inability to accurately predict the outcome of a radical change, difficulty in capturing existing processes in a structured way, shortage of creativity in process redesign, the level of costs incurred by implementing the new process, or inability to recognize the dynamic nature of the processes.

The main objective of the paper was to develop a simple simulation model of Web-based retail business process that could be used to evaluate the potential benefits and constraints of a BPR project. A brief overview of e-business renovation strategies and their evaluation is presented in Section 2. Simulation modelling tool Optima is described in Section 3. An example of modelling procurement processes is provided in Section 4. The applicability of simulation modelling and evaluating alternative business process strategies is investigated. Finally, Section 5 outlines the main findings of this research and provides concluding remarks.

2 Assessing the benefits of e-business implementation

An e-business model generally means the adoption of company's current business model to the Internet economy. Main purpose of developing and analysing business models is to found revenue and value generators inside reversible value chain, or business model's value network. BPR in 90-s has been focused on internal benefits such as cost reduction, downsizing of company and operational efficiency which are rather tactical then strategic focus. Nowadays, e-business renovation strategies put their focus on the processes between business partners and the applications supporting these processes. These strategies are designed to address different types of processes with the emphasis on different aspects [11, 7]: customer relationship management (CRM), supply chain management (SCM), selling-chain management and enterprise resource planning (ERP).

It is well known that e-business might bring several advantages to the company. However, existing practical business applications have not always been able to deliver the benefits they promise in theory. Prior to adopting e-business, companies need to assess the costs needed for setting up and maintaining the necessary infrastructure and applications and compare it with the expected benefits. Although the evaluation of alternative solutions might be difficult, it is essential in order to reduce some of the risks associated with BPR projects.

Simulation has an important role in modelling and analysing the activities in introducing BPR since it enables quantitative estimations of influence of the redesigned process on system performances [2, 14]. Simulation of business processes represents one of the most widely used applications of operational research as it allows understanding the essence of business systems, identifying opportunities for change, and evaluating the impact of proposed changes on key performance indicators. The design of business simulation models that will incorporate the costs and effects of e-business implementation and will allow for experimentation and analysis of alternative investments is proposed as a suitable tool for BPR projects. Some of the benefits can be directly evaluated and predicted, but the others are difficult to measure (intangible benefits). Some of the intangible benefits might be (as observed in several case studies in Slovenian companies that have introduced e-sales): improved image of a company as a whole, increased market share, better relationships with the business partners, better data quality, and increased customer satisfaction. This research investigates some of the benefits and outcomes of introducing new processes (time and cost savings, workload reduction and increased throughput) that could be measured in advance, by simulation modelling.

3 Business process modelling and simulation using Optima

Process modelling is one of the most cost-effective and rewarding ideas to come along in years. Many different techniques can be used for modelling business processes in order to give an understanding of possible scenarios for improvement [10], Flowcharting, IDEF0, IDEF3, Petri Nets, System Dynamics, Knowledge-based Techniques, Activity Based Costing and Discrete-Event Simulation are only some examples of business process modelling techniques widely used [5]. There are also many software tools on the market that use these modelling techniques. According to Curtis et al. [3], a modelling technique should be capable of representing one of more of the following modelling perspectives: functional (represents what activities are being performed), behavioural (represents when and how activities are performed), organizational (represents where and by whom activities are performed) and informational (represents the informational entities – data). Deeper analysis

of simulation modelling techniques suggests that these are suitable to address at least the functional, behavioural and organizational perspectives [1].

This study presents Optima [9] (Micrografx) software as a suitable tool for process mapping and simulation modelling in BPR projects. An activity is an individual step of a process map presented as a symbol in a flowchart. Each activity can set or determine the following information: inputs, resources (an activity can use several resources or more than one kind of resource simultaneously), task (the task information covers the duration that the activity takes to complete, its associated costs, activity base, and schedule) and outputs. Modelling elements are connected with links that describe the process flow. Each activity is placed in one or more departments that represent an organizational unit that performs these activities.

4 Simulation modelling of procurement process

Most business is business-to-business [8] Thus, there is a huge potential for introducing e-commerce in the inside part of the value chain. One of the reasons why this type of e-commerce could be easier to implement is that large proportion of transactions are in this case repeat orders. On the other side, there are several problems and obstacles that the companies introducing the business-to business model of e-commerce are faced with. The investments in information technology can be significant, industry common standards are yet to be emerged and adopted, the way that the company operates has to be (sometimes radically) changed. But the results can be rewarding for both sides in the form of savings through reduced costs, process efficiencies, and compliance [4].

This study refers to a business change effort undertaken by a virtual company. The process itself is adapted from a case of a real Slovene company. The emphasis of the study was on the assessment of savings in terms of time and cost for one purchase transaction execution.

In the first step of the research, "AS-IS" model was developed (Figure 1). The procurement process is performed in four departments: Purchasing, Warehouse, Finance, and Accounting. Six employees work on this process; the detailed list can be found in Table 2. The details about activities are presented in Table 1.

The simulation of *two years* was performed and the report has shown that an average procurement process lasts for about 10 days and the average cost is 54.8 EUR. However the simulation report, no matter how precise and deep it is, is not the only way to use the business process modelling for analysing problems of such a process execution. It is very often that business process maps itself show many problems that have not been observed before. In our case there are two main (and often) problems discovered:

- The communication inside the company and between the company and the suppliers is slow and ineffective; consequently there are many time gaps in the process execution.
- Many times the same data are inserted and therefore there are good chances to have low data quality [12].

The results of the analysis were used in *the second phase* of this research, as the basis for introducing new business model of the procurement process ("TO-BE" model). The workflow management system and electronic data interchange over the Internet with the suppliers were introduced.

From the process map itself not many differences can be observed between the AS-IS and TO-BE model. However the most important differences are in he way how some of the

activities are performed. On the other hand, this is usually the most difficult part of introducing new or reengineering existing business processes.

In our case the models were analysed and compared according to the time and cost of an average process execution (Table 2). The results of the comparison showed that by using the proposed solutions the time could be halved. Also the costs can be significantly cut from (on average) 54.8 EUR to 30.7 EUR for one process execution.

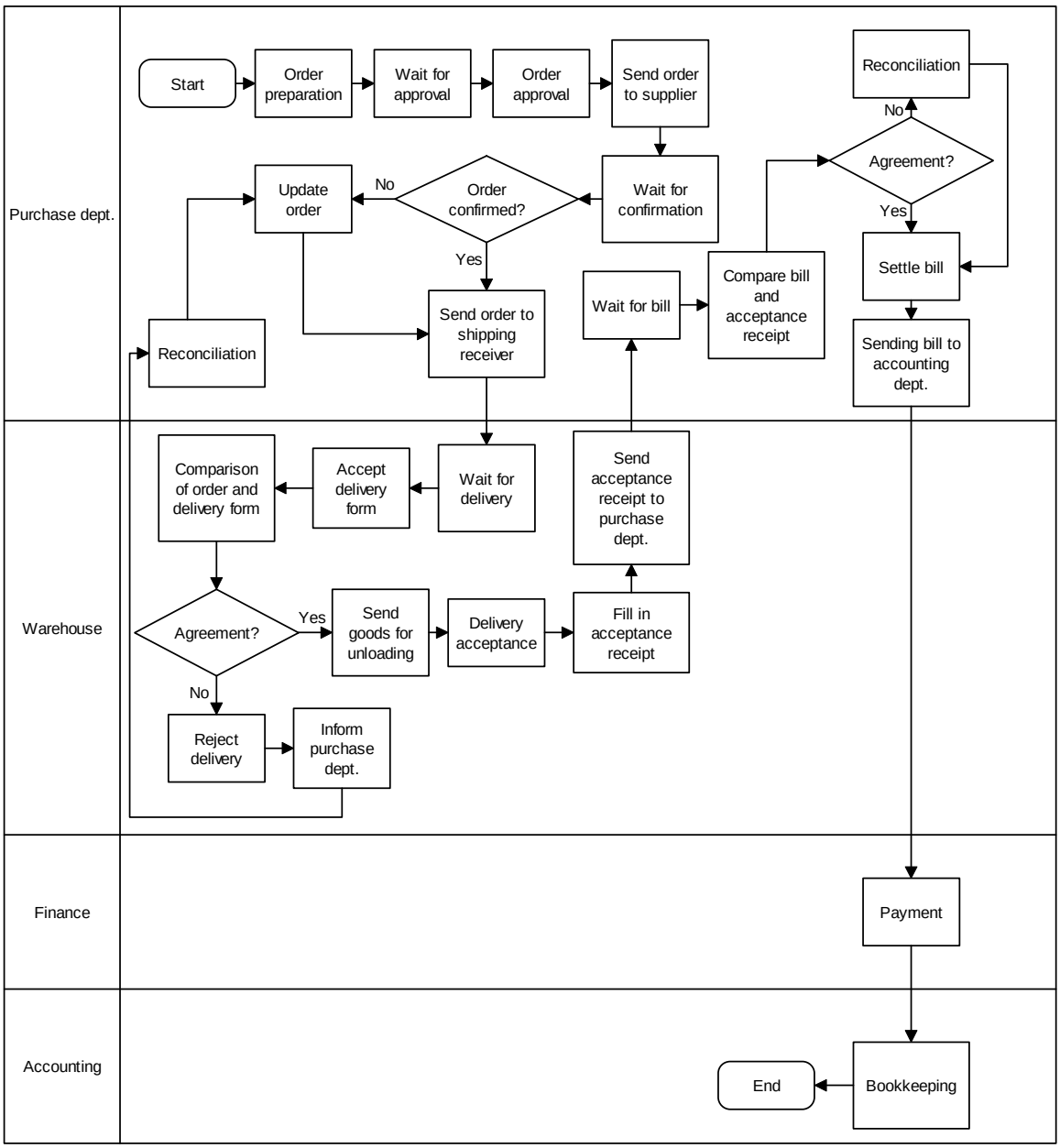

Figure 1: Existing process (AS-IS model)

Of course there should not be forgotten some other important benefits that are more difficult to be measured or evaluated in advance. For example, we have already mentioned the data quality; the other could be better working relationships with the suppliers, suppliers have better and more accurate evidence of our needs and they can react more promptly to our demands. On the other side, there are also several problems with introducing e-business solution, especially in the B2B model; there is always high cost and risk associated with such project.

Activity	Resources	Time	Outputs
Order preparation	Purchaser	1 - 3 hrs	
Wait for approval		0 - 24 hrs	
Order approval	Purchasing manager	10 min	
Send order to supplier	Purchaser	10 min	
Waiting for order conformation		1 - 48 hrs	
Order confirmed (availability, prices etc.)?			Yes - 80%, No - 20%
Update order	Purchaser	10 - 20 min	
Send order to shipping receiver	Purchaser	10 min	
Wait for delivery		1 - 7 days	
Accept delivery form	Shipping receiver	1 min	
Comparison of order and delivery form	Shipping receiver	5 - 20 min	
Agreement?	Shipping receiver		Yes - 90%, No - 10%
Reject delivery	Shipping receiver	20 min	
Reconciliation with the supplier	Purchaser	30 - 120 min	
Inform purchase dept.	Shipping receiver	20 min	
Send goods for unloading	Shipping receiver	5 min	
Delivery acceptance	Warehouseman	15 - 120 min	
Fill in the delivery document	Warehouseman	10 - 30 min	
Send acceptance receipt to purchase dept.	Warehouseman	10 min	
Wait for bill		1 - 3 days	
Compare bill and acceptance receipt	Purchaser	5 - 20 min	
Agreement?			Yes - 95%, No - 5%
Reconciliation with the supplier	Purchaser	30 - 120 min	
Settling the bill	Purchaser	10 min	
Sending the bill to the accounting dept.	Purchaser	10 min	
Payment	Financier	20 min	
Bookkeeping	Accountant	20 min	

Table 1: Activities in AS-IS model

Duration of the simulation		2 years
Employees	Number	Hourly rate
Purchaser	1	10 EUR
Purchasing manager	1	15 EUR
Shipping receiver	1	10 EUR
Warehouseman	1	7.5 EUR
Financier	1	12.5 EUR
Accountant	1	12.5 EUR
	AS-IS model	**TO-BE model**
Time for one transaction (Cycle time)	10 days	5 days
Costs of each transaction	54.8 EUR	30.7 EUR

Table 2: Parameters and comparison of the two models

5 Conclusions

Survival and growth of enterprises in current market conditions demands constant modernisation of the business processes. One of the ways to accomplish these goals is BPR using additional features included in simulation modelling methods. In this research a "prototype" of the e-procurement model was developed using Optima process mapping and simulation tool. The benefits of the e-commerce implementation were analysed and scenarios were compared. Business process modelling and discrete-event simulation proved to be valuable mechanisms for realising the real business value of business-to-business e-commerce model. A real-life case study should be explored through further research in order to evaluate the added value of electronic commerce.

6 References

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