

Evaluation Of Alternative E-Business Models By Business Process Simulation Modeling

JURIJ JAKLIC, MOJCA INDIHAR STEMBERGER, ANDREJ KOVACIC, VESNA BOSILJ-VUKSIC[°]

Business Informatics Institute
University of Ljubljana, Faculty of Economics
Kardeljeva ploscad 17, 1000 Ljubljana
SLOVENIA

[°] Information Systems Department
University of Zagreb, Faculty of Economics
Trg J.F.Kennedyya 6, 10000 Zagreb
CROATIA

Abstract: - Business process modeling, simulation, and an evaluation of different alternative scenarios for improvement has been proven to be promising tools for decreasing the risk related to business process reengineering projects. Business renovation as the highest level of strategy for managing change in an organization is the key element of electronic business orientation. Business process simulation is investigated as a tool for deriving an additional in-depth understanding of how the process is executed, an identification of the sources of the problems observed during the process execution, etc. An example of how simulations can be used for understanding a process and evaluation of how the proposed improvements and introduction of electronic business will influence the system performance is presented.

Key-Words: - simulation modeling, business process modeling, process maps, e-business, business renovation, business process reengineering

1. Introduction

As observed by [6], dynamic modeling has a long history and generally a favorable reputation when it is used to improve a specific business operation and it has proven quite useful when routines are stable. Business Renovation (BR) or business process renovation and an introduction of information systems (IS) efforts integrate a radical strategic method of Business Process Reengineering (BPR) [4], [9], [13] and more progressive methods of Continuous Process Improvement (CPI) [1], [5] with adequate Information Technology (IT) infrastructure strategies. Some of the frequently mentioned problems related to BPR include *an 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 an inability to recognize the dynamic nature of the processes*. The methods of BR, which includes business process modeling with simulation modeling that enables quantitative estimations of the alternative renovated business processes [2], are one of the possible approaches to address the above mentioned problem of the evaluation of alternative solutions. In most instances several models are built, one that represents the current

practices, named as the AS-IS model, and several proposals for business process renovation, TO-BE models.

Competitive conditions and pressures in the global market are forcing companies to search for strategies of streamlining the entire value chain. Increasing the effectiveness of the value chain will increase the competitiveness of a company. To compete effectively, organizations must structurally transform their internal and external processes. These goals could be reached by a simultaneous renovation of business processes and an implementation of electronic business models.

Electronic business (e-business) is an execution by electronic means of interactive, inter-organizational processes [3]. E-business represents a shift in the business doctrine that is changing traditional organizational models, business processes, relationships and operational models that have been dominant for the past 20 years. The new doctrine of e-business requires an enterprise to integrate and synchronize the strategic vision and tactical delivery of products to its customers with the information technology and service infrastructure needed to meet this vision and process execution. In the next few years, successful enterprises will restructure their organization, process and

technology infrastructure for successful e-business execution.

It is well known that e-business might bring several advantages to a company. However, existing practical business applications have not always been able to deliver the benefits they have promised 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 they need to compare it to the expected benefits. Several alternative e-business models might be taken into consideration. Although the evaluation of alternative solutions might be difficult, it is essential because it reduces some risks associated with the introduction of e-business. The business processes should be analyzed first in order to find out if they are well defined, adequate, and ready for the implementation of new information technology. In this way only, an improvement of quality, lower costs, and shorter performance times could be expected.

The main objective of this paper is to develop a simulation model of business-to-business (B2B) electronic commerce process that could be used to evaluate the potential benefits and constraints of a BR and an introduction of e-business project. Following a discussion on the role of business process modeling and simulation in the BR context (Section 2), an example of modeling business-to-business (B2B) processes is provided in Section 3. At this point, the applicability of simulation modeling and the evaluation of alternative business process strategies are investigated. Finally, Section 4 outlines the main findings of this research and provides concluding remarks.

3. The Role Of Business Process Modeling And Simulation

Simulation has an important role in modeling and analyzing the activities in introducing BPR since it enables quantitative estimations on influence of the redesigned process on system performances [2]. The 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 is proposed as a suitable tool for BR projects; it will incorporate the costs and effects of e-business implementation and will allow for experimentation and analysis of alternative investments.

Many different methods and techniques can be used for modeling business processes in order to give an understanding of possible scenarios for improvement.

Flowcharting, eEPC (enhanced Event-driven Process Chain), IDEF0, IDEF3, Petri Nets, System Dynamics, Knowledge-based Techniques, Activity Based Costing and Discrete-Event Simulation are only some examples of business process modeling techniques widely used [8]. There are also many software tools on the market that use these modeling techniques.

In [10] the empirical review of existing methodologies, tools, and techniques for business process change was conducted. The authors also developed a reference framework to assist positioning of tools and techniques that help in re-engineering strategy, people, management, structure, and technology dimensions of business processes. However, relevance is far more important than completeness [6] and simple models are far more understandable for non-specialists. Process modeling tools must be able to show interconnections between the activities and to conduct a decomposition of the processes. These tools must help users to conduct “what-if” analysis and to identify and map no value steps, costs, and process performance (bottleneck analysis). They should be able to develop AS-IS (model of current business processes) and TO-BE models of business processes, which represent both existing and alternative processes. It must be validated and tested before the implementation. It can be used to predict characteristics that cannot be directly measured, and it can also predict economic and performance data that would otherwise be too expensive or impossible to acquire. It is clear that not all renovation and e-business benefits can be directly evaluated and predicted; some are difficult to be measured (intangible benefits).

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 modeling. The reasons for the introduction of simulation modeling into process modeling can be summarized as follows:

- Simulation enables modeling of process dynamics,
- Influence of random variables on process development can be investigated,
- Anticipation of reengineering effects can be specified in a quantitative way,
- Process visualization and animation are provided,
- Simulation models facilitate communication between clients and an analyst.

This study presents iGrafx Process [11] software as a suitable tool for process mapping and simulation modeling in BPR projects. One of the main advantages of this modeling technique is its simplicity; even people unskilled in business process modeling can easily understand and use this technique. Also, iGrafx Process is very powerful in simulations. It can generate many

useful reports regarding the duration of each transaction, costs, resource utilization, etc. at the end of the simulation.

Figure 1 shows basic modeling elements of the process maps technique that is used by iGrafx Process. 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 (a person, machine, or other asset that may perform the activity), task information (the duration of the activity, its associated costs, activity base, schedule), outputs, etc.

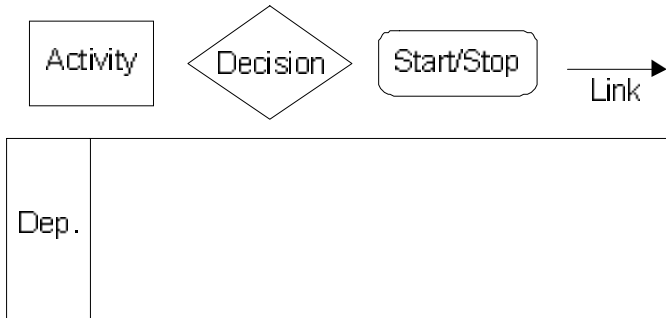


Fig. 1. Basic modeling elements of the process map technique

Modeling elements are connected with links which describe the process flow. Each activity is placed in one or more departments that represent an organizational unit which performs these activities. A transaction can be split in order to be processed simultaneously by different departments or resources, and batched again in a single transaction. Each activity can be defined in detail by several attributes, such as: types and number of resources performing the activity, duration of the activities, which can be constant or stochastic, value-type costs (value added, non value added, or business value added).

The costs of the resources utilization can be defined according to the hourly rates, rates per use, and overtime rates. Schedules for resources and event generators are fully customizable. All the above-mentioned and other possibilities offer a detailed cost and time analysis of business processes. The reports generated by the iGrafx Process software allow the re-engineering effects to be anticipated and show the results in quantitative parameters, such as the number of transactions in queue, the cost and time of the utilization of the resources and the time of the process cycle.

4. Simulation Modeling Of B2B Process

This study refers to the indirect procurement process of a virtual company. Several interviews in different Slovenian companies were performed to obtain as realistic process model as possible. Therefore the results of the presented analysis can be used as a rough estimation for any company with similar indirect procurement process. The procurement process is usually considered as unstrategic and therefore overlooked. However, savings in this area can be huge. Knowledge of established contracts and of what buyers are actually spending on each supplier's product is the key to making compliance and leverage possible and worthwhile. For example, a 10 percent reduction in indirect procurement cost can result in a 50 percent increase in profit margin [7]. On the other hand, several problems and obstacles occur during the introductory phase of the B2B model. The investments into information technology can be significant, industry common standards are yet to emerge and to be adopted and 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 [7].

The study emphasizes the assessment of savings in terms of time and cost for the execution of one purchase transaction. During the first phase of the research, an AS-IS model was developed (Figure 2). The indirect procurement process starts in any department where a need is identified and is performed in three departments: Purchasing, Warehouse and Finance/Accounting. There are seven employees working on this process; a detailed list can be found in Table 1.

The simulation of a two-year performance was carried out, with the assumption that the process starts every 1 to 5 hours during working time. The report shows that an average indirect procurement process lasts for about 20 days and the average cost is €50. However, the quantitative results of the simulation experiment presented in the simulation report, no matter how precise and deep the simulation is, are only one aspect of the business process analysis. Business process maps themselves can frequently show many problems that have not been observed before. In this research two main (and very common) problems have been discovered:

- First, the communication between the insiders of the business process and the communication between the company's employees and its suppliers is slow and ineffective; consequently, many time gaps occur in the process execution.
- And second, very often during the process execution, the same data are inserted (e.g. purchase order and acceptance slip) and therefore problems of data inconsistency, integrity and accuracy occur [12], [14].

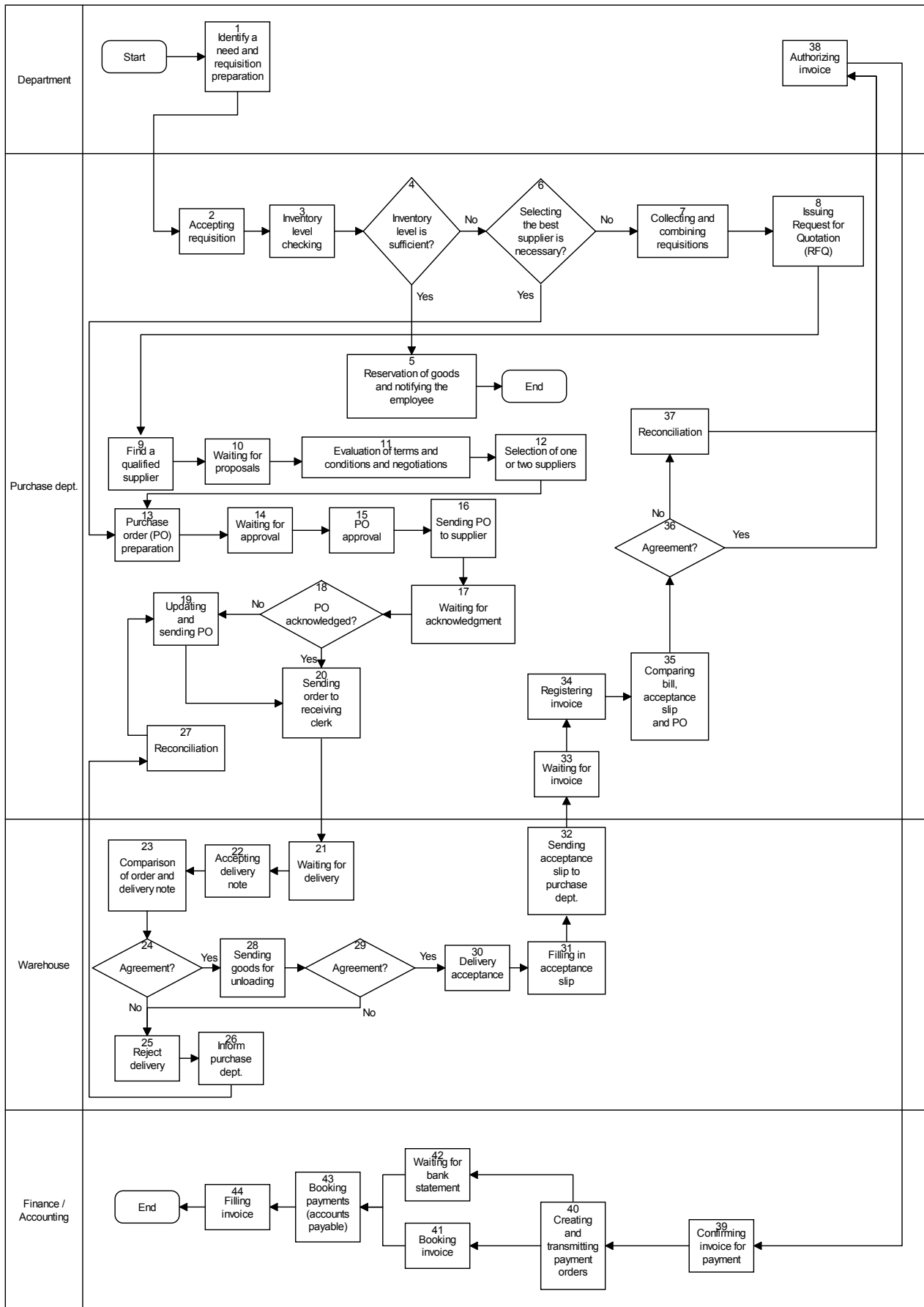


Fig. 2: Existing process (AS-IS model)

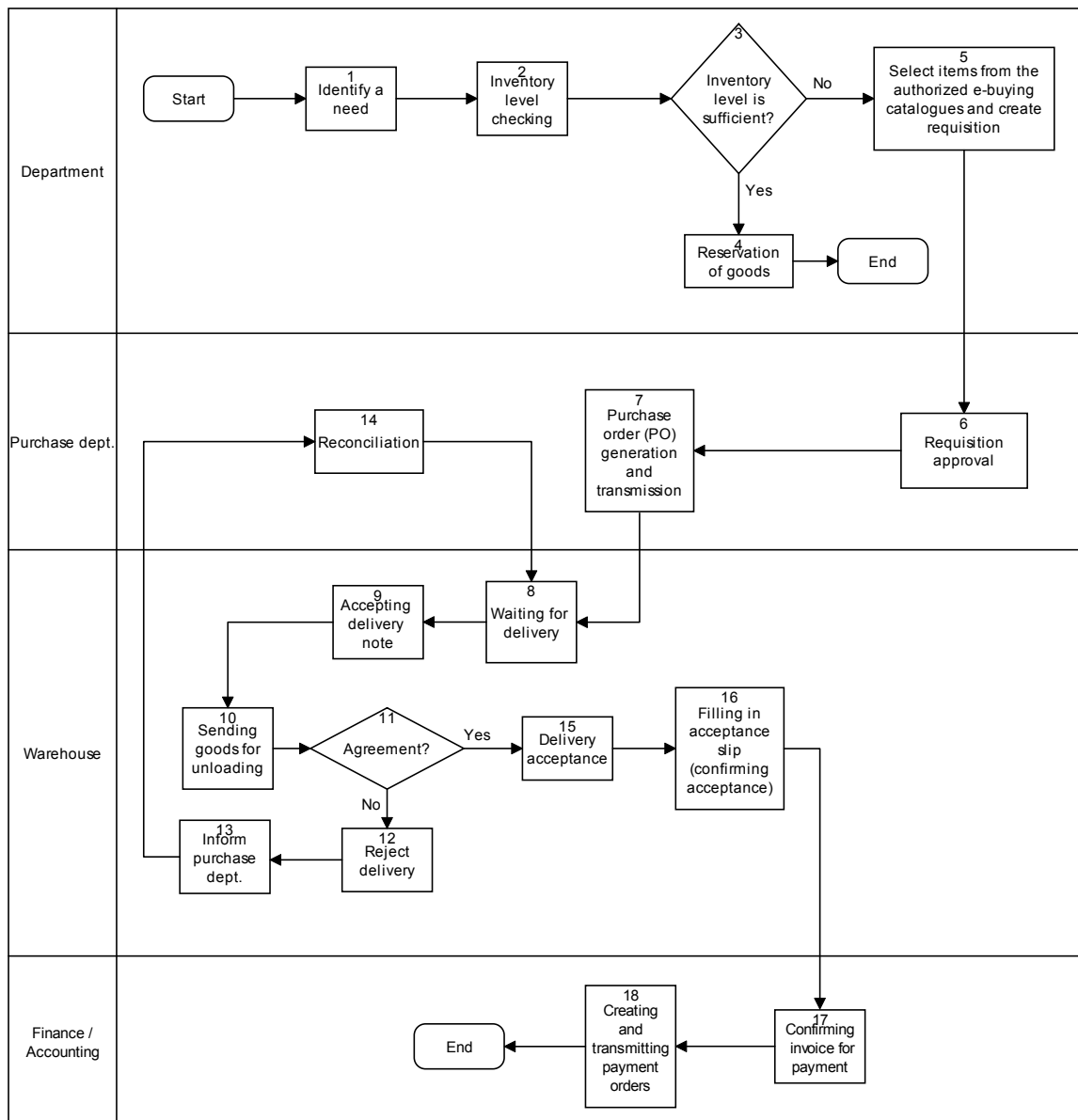


Fig. 3: Renewed process (TO-BE model)

In the second phase of the project some changes and improvements in the procurement process were proposed. Many changes come from the introduction of new technology, although many of them are of an organizational nature (different ways of working). This is usually the most difficult part of introducing new, or re-engineering existing, business processes. The following changes relating to the introduction of e-business inside the company and with the suppliers were assumed:

- Long-term contracts and e-business connections are implemented with the selected suppliers.
- Electronic product catalogues and product configurators are available to employees.
- Product availability and pricelists are available on-line.

- Approval and authorization procedures are preconfigured in the electronic indirect procurement process (automated) to ensure they conform to policies.
- A workflow management system is used in the company.
- Comparing bill, acceptance slip and purchase order (PO) is supported by an integrated database.
- Electronic delivery tracking is offered.
- Electronic payment is introduced.

A TO-BE model of the indirect procurement process was developed. Its process map is shown in Figure 3. Many activities became unnecessary, while some others were performed more efficiently.

Both models (AS-IS and TO-BE) were analyzed and compared according to the time and cost of an average

process execution (Table 1). The results of the comparison show that the time could be significantly shortened if the proposed solutions are used. The costs can also be cut from (on average) €50 to €36 for one process execution.

Of course, one should stress other important benefits that are more difficult to be measured or evaluated in advance, such as better working relationships with suppliers, suppliers having better and more accurate evidence of the company's needs and who react more promptly to partners' demands. On the other hand, several problems can occur in the introduction of e-business solutions, especially in the B2B model; high costs and risks are always associated with such a project.

Duration of the simulation		2 years
Employees	Number	Hourly rate
Employee (any)		€15
Purchasing officer	1	€10
Purchasing director	1	€20
Receiving clerk	1	€10
Warehouseman	1	€8
Financier	1	€15
Accountant	1	€15
	AS-IS model	TO-BE model
Time for one transaction (Cycle time)	20 days	5 days
Costs of each transaction	€50	€36

Table 1: Parameters and comparison of the two models

6. Conclusion

E-business represents a shift in the business doctrine since it changes traditional organizational models, business processes, relationships and operational models. The corporate value chain links the different processes and players in the domain of e-business. Therefore, most traditional firms will not be able to conduct business in the traditional manner any longer. One of the ways of accomplishing these goals is BR, which uses additional features included in simulation modeling methods.

In this research, the indirect procurement process of a virtual company and proposed e-procurement process implementation were modeled using the iGrafx Process modeling and simulation tool. The e-business environment and its characteristics were examined, and this was followed by an evaluation of the impact of electronic commerce on the procurement process. The costs and benefits of future e-business implementation were analyzed. The results of the research show that

business process modeling and discrete-event simulation are valuable mechanisms for realizing the real business value of B2B e-commerce.

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