IMPROVEMENT OF BUSINESS PROCESS SURGERY USING SIMULATION

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Abstract: This paper discusses the possibility of finding a better solution for the problem of business process improvement using simulation technique. Most of problems of organisations are originated in fact that their business processes are neither well defined nor particularly efficient. Business process modelling is done by identifying a certain business process, defining its activities, and using a modelling technique to develop its model. Process improvement is carried out by precise analysis of the process, suggesting changes and improvements, and giving solutions for existing problems. To achieve this, we concentrate our work on analysing and simulating the business process discussed. This means that the simulation results need to be analysed and understood in order that the analyst is able to suggest necessary changes. A complete understanding of the results of process simulation is an essential precondition to move forward with business process improvement. The problem of conducting a surgery is used as an example to carry out business process improvement using simulation technique.

1 INTRODUCTION

The aim of this paper is to introduce the importance of using simulation technique in the field of business process improvement. The purpose of using simulation is to analyse the current or the alternative version of the business process discussed in order to determine its behaviour and carry out further improvements by solving problems, removing obstacles and identifying bottlenecks existing in the process.

A process model, which represents a true reflection of the business process discussed, is essential for carrying out business process improvement and information system development successfully. Business process improvement became a very important way of ensuring changes in an organisation's structure and functioning in order to create a better, more competitive and successful enterprise.

In Section 2, different definitions and explanations of business process published by well-known authors are presented. In Section 3, business process modelling is discussed. In Section 4, business process simulation as a technique for business process improvement is introduced. The last section contains some useful remarks and conclusions. In this work, the problem of business process Surgery is used to illustrate the use of simulation to improve business processes.

2 BUSINESS PROCESS

Most of problems faced by enterprises concern internal business procedures that are neither well defined nor particularly efficient (Hales, 1993; Lavery, 1992; Medina-Mora et al., 1992).

Business processes come within our scope in that they potentially add value to the organisation and as such are attracting attention (examples given in Martinez et al. 2001; Aguilar-Saven, 2001; Chan, 2002; Hammer, 1990; Hammer and Champy, 1993; Davenport and Short, 1990 and so forth). Consequently, business process modelling is on the increase as only

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a thorough comprehension of the business processes within the organisations can lead to effective, efficient and value-adding systems. According to Aguilar-Saven and Olhager (2002), it is the business processes that are the key element when integrating an enterprise.

A process is defined as structured, measured sets of activities designed to produce a specified output for a particular customer or market (Davenport, 1993). Hence, a process converts inputs by summing their value through various activities into outputs. However, Aguilar-Saven (2003) stressed that a business process is related to the enterprise, as it defines the way in which the goals of the enterprise are achieved.

To sufficiently define a process, firstly the process activities need to be identified, and then the sequence order of the identified activities needs to be established. Resources are origins of supply, material assets required to activate process activities and are consequently twofold; capital assets and labour (Laguna and Marklund, 2005). They are exploited within the process but not consumed.

To identify business processes, we organize interviews with the management at strategic and business levels. The purpose of the interviews with strategic management is to define the strategic goals and objectives of the enterprise. After that, we continue conducting interviews with the management at business level. Actually, the results of these interviews are valuable information, which enable us to create a list of business processes of the organization discussed. In addition, the interviews are also useful in discovering the organizational scheme of the enterprise.

Surgery: The management of a Clinic of abdominal surgery wished to improve this process of conducting a surgery by making it more efficient and less time consuming. As a result of conducting interview with the management, one business process was identified called Surgery, which covers the whole problem discussed.

3 PROCESS MODELLING

Conceptual modelling of business processes is deployed on a large scale to facilitate the development of software that supports the business processes, and to permit the analysis and re-engineering or improvement of them (Aguilar-Saven, 2003).

The business process modelling system is a computer-based, potential solution to these problems. It is a system for managing a series of tasks (actions) defined for one or more procedures (Scholz-Reiter and Sticker, 1996). Business process modelling generates a model to describe a certain business process in an enterprise using different techniques. A model is a representation of a business process, which reflects its reality by capturing all the necessary information on process behaviour. The modelled process is then analysed and improved instead of the real business process.

To model a business process, we continue with organizing interviews with the employees of departments corresponding to the plan of interviews developed earlier. The aim of these interviews is to define in detail the work processes of the process identified and their activities.

Work processes are the sets of procedures or activities, tasks, and steps where the real work of the organization is accomplished to produce the economic output that generates the profitable return on the capital employed (Watson, 1994). There are many methods and techniques used in the field of business process modelling. In the framework of this paper the flowchart technique was chosen to model business process Surgery. A flowchart is a simple diagram, which is used to model business processes in software packages such as iGrafx. In addition to process modelling, iGrafx also enables us to perform simulation of the modelled processes. The paper does not discuss simulation; as such a discussion would exceed the scope of this paper.

The flowchart technique defines a flowchart as a formalised graphical representation of a program logic sequence, work or manufacturing process, organisation chart, or similar formalised structure (Lakin et al., 1996). A flowchart is commonly used to show the flow of a process from its start to its end. It usually consists of different symbols connected by lines, arranged in such a way to lead us through a series of steps in the correct sequence order.

Process flow is traced by following the connecting lines between the symbols drawn. These symbols include: start and end, activity, input and output, decision, and department. A flowchart begins with a starting point and finishes with an ending point. The terminus symbol is commonly used in flowcharting to designate the beginning and the end.

An activity is represented by a rectangle and means an elementary task. An input is indicated by an arrow, which enters an activity. An output is shown by an arrow, which leaves an activity. An arrow connects one activity to another, showing the movement of the diagram. A decision specifies alternative paths based on some Boolean expression and is shown by a diamond. There can be only one

path to a decision, but there can be many output paths (Arlow, Neustadt, 2002).

According to Aguilar-Saven (2003) flowcharts are built to offer an enhanced comprehension of the processes, which is a requirement for process improvement. By grouping tasks into logical areas of activity (processes) and drawing flowcharts of the events which occur, it is possible to get a concise picture of the way particular processes are completed within the organisation[1]. The flexibility of the flowchart technique is argued by many to be its advantage as it allows each modeller to unite various pieces of the process together to gain the overall picture as he/she feels they fit best. On the other hand, some argue that the technique is too flexible, describing large models without illustrating the hierarchy of different layers.

4 PROCESS SIMULATION

Business processes are modelled with the aim of analysing their current states within the organization, as well as improving them through the execution of potential "what-if" simulation scenarios (Aguilar-Saven and Olhager, 2002). Simulation modelling according to Pidd (1998) is based on very simple principles: the analyst builds a model of the system of interest, writes a computer program which embodies the model and uses a computer to initiate the system's behaviour when subject to a variety of operating policies. Simulation is the imitation of the operation of a real-world process or system over time (Banks et al., 2001). A simulation model enables the analyst to observe and study the system's behaviour as it advances through time.

The aim of using simulation is to analyse the current or the alternative version of the business process discussed in order to determine its behaviour and carry out further improvements by solving problems, removing obstacles and identifying bottlenecks existing in the process.

To run the simulation, we have to transform the content of the activity table into a flowchart or other diagram depending on the simulation software used. In our example, we used the flowchart diagram because iGrafx software was used to run the simulation of the process. Furthermore, the information stored about the activities of the business process was used to define the characteristics of the activities and develop the process model as is required by iGrafx software. The step of process simulation could be summarized by using the following algorithm:

a. create the process diagram (flowchart);
b. develop the process model by defining the properties of each activity;
c. define process simulation parameters and run the simulation;
d. analyse carefully the simulation results;
e. make changes to improve the process if possible; and
f. return to c if changes have been made.

Surgery: To carry out simulation of the business process "Surgery", the process model was built by using the information stored about the process and its activities to define the model's characteristics.

The simulation of the process "Surgery" was run taking into consideration a Clinic for abdominal surgery with a capacity of 30 beds; 20 patients were already in the Clinic in different phases of the process, and 30 patients were scheduled for different forms surgeryIn addition to this, we postulated that 3 patients from the planned 30 patients were hospitalized every day. To do that, a standard calendar was used, that is, 8 hours/day, 5 days/week and 22 days/month. And the following resources were defined: 1 Nurse and 1 Doctor in the Reception Office, 4 Nurses and 4 Surgeons in the Clinic, 1 Nurse in the Laboratory, 1 Nurse and 1 Doctor in the X-Ray unit, 1 Nurse and 1 Doctor in Anaesthesia, 2 Anaesthetists and 2 Nurses for performing anaesthesia in the Surgery block, 2 Anaesthetists and 2 Nurses for waking up patients and post-surgery recovery in the Surgery block, and 2 Nurses working with the Surgeons to carry out operations in the Surgery Block.

The results of running the simulation of the business process "Surgery" were as follows:

- Average cycle time for one patient is 14.68 days;
- Elapsed time for carrying out surgery for 30 patients is 25.57 days. This is understandable because the software needed 10 days to enter 30 patients into the Clinic (3 patients per day);
- Average time for performing different activities before surgery is 2.94 days. This is 1.43 days for performing various medical examinations in the Reception Office and Clinic, and 1.51 days waiting for surgery;
- Average time for performing anaesthesia, surgery and post-surgery recovery in the Surgery block is 7.1 hours;

[1] http://www.hci.com.au/hcisite2/toolkit/flowchar.htm

- Average time for recovery in Intensive care is 4.26 days;
- Average time for recovery in the Clinic is 6.39 days;
- Average time for creating a release form is 0.78 hour.

These results show that the process "Surgery" could be improved by considering the following suggestions:

- The time for performing different activities before surgery (average is 2.94 days) could be shortened by carrying out most of these activities before the patient's hospitalization or organizing them better;
- The recovery time in Intensive care (average is 4.26 days) should be reduced when possible;
- The recovery time in Clinic (average is 6.39 days) should be shortened when possible.

5 CONCLUSION

Developing a visible and comprehensible model, which represents a true reflection of the real business process, is essential in making the task of process analysis and identification of the necessary changes possible. The aim of this work was to study the possibility of using simulation technique for carrying out business process improvement.

To carry out the improvement of the business process "Surgery", process model was developed as a flowchart diagram of iGrafx software to run a simulation of the process. The results of the process simulation are very encouraging and show that the process "Surgery" is well planned and does not have major problems. Nevertheless, the process could be improved by shortening the time of 2.94 days spent before surgery; this is 1.43 days for performing different medical examinations in the Reception Office and Clinic and 1.51 days waiting for surgery. Some of the medical examinations could be done before hospitalization and also the time of waiting for surgery could be shortened. Furthermore, the recovery time in Intensive care (4.26 days) and the Clinic (6.39 days) could be reconsidered.

We are aware that these suggestions cannot be generalized for all patients, but they are good points for the medical staff to rethink. This fact proves that using simulation in the field of business process improvement could be very important.

REFERENCES

Aguilar-Saven, R.: Business Process Modeling. Review and Framework. Internatinal Journal of Production Economics, Vol. 90, No. 2, (2003) 129–149.

Aguilar-Saven, R.: Business Process Modelling techniques and tools, Department of Production Economics, WP291, Linkoping (2001), Sweden.

Aguilar-Saven, R. and Olhager, J.: Integration of Product, Process and Functional Orientations: Pr inciples and a Case Study, Preprints of the International Conference on Advanced Production Management Systems, APMS 2002, IFIP, The Netherlands.

Arlow, J., Neustadt, I.: UML and the Unified Process - Practical Object-Oriented Analysis & Design, Pearson Education, Boston (2002).

Banks J., Carson II J.S., Nelson B.L., Nicol D.M., Discrete-Event System Simulation, 3rd Edition, Pretence Hall International Series in Industrial and Systems Engineering, Prentice Hall, Inc., Upper Saddle River, New Jersey, 2001.

Chan, M.: A Framework to Develop an Enterprise Information Portal for Contract Manufacturing, International Journal of Production Economics, Vol. 75, No. 1–2, (2002) 113–126.

Davenport, T.H.: Process Innovation: Reengineering Work through Information Technology, Harvard Business School Press, Boston (1993), MA, USA.

Davenport, T.H., Short, J.: The New Industrial Engineering: Information Technology and Business Process Redesign, Sloan Management Review, Vol. 31, No. 4, (1990) 11–27.

Hales K.: Workflow Management. An overview and some applications, Information Management and Technology, Vol. 26, (1993).

Hammer, M.: Reengineering work: Don't automate. Obliterate, Harvard Business Review, Vol. 68, No. 4, (1990) 104–112.

Hammer, M. and Champy, J.: Reengineering the Corporation, A Manifesto for Business Revolution, New York (1993).

Laguna, M. and Marklund, J.: Business Process Modelling, Simulation, and Design, Pearson Education, Inc. New Jersey (2005).

Lakin R., et al.: BPR Enabling Software for the Financial Service Industry, Management Services, (1996), ISSN: 0307-6768.

Lavery M.: A Survey of Workflow Management Software. Proceedings of Conference on OIS Document Management, 1992.

Medina-Mora R., Winograd T., Flores R. and Flores T.: The Action Workflow Approach to Workflow Management Technology, in ACM (ed.): CSCW Proceedings, Toronto 1992, 1-10.

Pidd M. Computer Simulation in Management Science. Chichester: John Wiley. 1998; 118-32.

Watson H.G.: Business Systems Engineering. Managing Breakthrough Changes for Productivity and Profit, John Wiley & Sons, New York 1994.