BPMN AND BPR: A NEW SHAPE OF BUSINESS PROCESSES

Łukasz Paśko

Abstract: *The aim of this paper is to perform the main part of the restructuring processes with Business Process Reengineering (BPR) methodology. The first step was to choose the processes for analysis. Two business processes, which occur in most of the manufacturing companies, have been selected. Afterwards, current state of these processes was examined. The conclusions were used to propose own changes in accordance with assumptions of the BPR. This was possible through modelling and simulation of selected processes with iGrafx modeling software.*

Keywords: *Business Process Reengineering, modelling and simulation processes*

Introduction

Importance of changes in organizations has been growing steadily for many years. Moreover, meaning of the word 'change' is still evolving. At the beginning of its history, it was associated with increase of productiveness. Currently, changes are introduced in order to improve the identification, comprehension and fulfilment of customers' needs [Hammer M ., 1999]. The implementation of the new ideas should not be done in chaotic manner. This assumption is provided by the concept 'restructuring'. It gives conceptual model, which allows for arrangement of the restructuring process [Durlik I., 2002], [Durlik I., 1998]. The model is especially important when the changes have a deep character and they cause modification of companies' mission or strategic objectives. The changes have to be adapted to current, dynamic environment [Hatch M.J., 2002]. It is possible, in particular, when companies carry out the reorganization with the use of Business Process Reengineering (BPR). According to the name, we cannot talk about a radical restructuring without focusing on the business processes [Hammer M ., 1999], [Manganelli R.L., Klein M.M., 1998].

The aim of this paper was to perform the main part of the restructuring process by using BPR methodology. The first step was to choose the processes for analysis. Two business processes, which occur in most manufacturing companies, were selected. Afterwards, current state of these processes was examined. The conclusions were used to propose own changes with accordance to assumptions of the processes reengineering. This was possible through modelling and simulation selected processes with iGrafx software.

Methodology and tool

Literature [Durlik I., 2002], [Durlik I., 1998], [Sapijaszka Z ., 1997] distinguishes two approaches of the restructuring: traditional and radical. Traditional approach based on more than a century of experience. Determinants of this type of restructuring were technical and economic. They were created based on scientific achievements of authors of the scientific management, such as: F.W. Taylor, K. Adamiecki, H. Ford. These criteria assume exploit materials, energy, productive area and machines, as great as possible. It is done by overall burden of production employees. The assumption connected with this kind of restructuring allowed for gradual development (at most 10% per year). It required rebuilding organization's structure and improving management. It was related with computerization and automation. However, improvement concerned the 'old' processes. These processes were not adjusted for computerization, because they were designed according to traditional way of information processing. The high investments on hardware and software caused that it was not

cost-effective. Thus, improvement can be achieved through traditional restructuring, but effects are often insufficient.

Radical approach is used to gain appropriate level of effectiveness. In this case, range of changes is wider. They include modification of many areas of company's activity. The basis is an examination and a fulfilling of customers' needs. Taking into account the employees, more important is creation and introducing a new way of thinking of each organization's member, than just participation in trainings and courses. The meaning of their work evolves from realizing tasks to achieving strategic objectives. Radical restructuring is, first of all, a thorough redesign of processes, which give a value for external and internal customers.

The radical restructuring is closely related with BPR concept. This methodology allows to achieving a several times higher results compared with the traditional approach. It is the modern approach to technical and economic restructuring of companies and institutions. Literature treats BPR as a radical rebuilding of processes from scratch which provides significant improve. Moreover, it is fundamental change of the thinking of all employees [Hammer M ., 1999].

The term, which occurs the most frequently in this paper, is a "business process". According to literature it is orderly set of tasks that require one or more factors of production and generate result, which is focused on fulfilling customers' needs .

Modelling and computer simulation have an increasingly important position amid tools are used by engineers and managers. This is the result of need to make quick and accurate decision in response to constantly changing environment. Furthermore, manufacturing systems are more complex than before. Through information technology that are applied in conjunction with software for modelling and simulation, issues difficult to solve due to the high complexity, can by deeply analysed. Modelling is to build a virtual model, which illustrates a real business process. Then, simulations are carried out on this model.

In literature [Podstawy projektowania.., 1993] shows both advantages and disadvantages of a simulation. The positive aspects, among other things, include:

- simplicity of changes the model;
- possibility to easy observe a business process in various situations;
- lower costs of creating model and carry out a simulations, than the real implementing and experimenting on a business process;
- shorter duration of simulations, than a time devoted to analyse process in the real world;
- chance to testing a process without modifying its flow and shape in reality.
- At the same time, literature lists disadvantages, such as:
- possibility of inappropriate mapping a process;
- necessity of having knowledge and experience with modelling;
- simulation of the various models that describe the same process, may be given different results.

After the simulation phase, the obtained results should be analysed. Afterwards, improvements are implemented into examined process. It is not easy and obvious operation, but time-consuming and often requires major investments. Also, the desired results of these actions are not guaranteed. Therefore, a modeller's experience is so important. The different ways to creating models are distinguished. The formal rule of modelling, which is generally acceptable, does not exist [Fertsch M., Grzybowska K., Stachowiak A , 2009]. However, at the beginning, objectives and issues of the design task are always defined. They affect range and level of detail of the model. In this phase, analyst's role is to collect information and data, then prepare them for carrying simulation. Second phase is to build and validation of a model. In the first step, data that describe mapped

process are provided. Then compatibility of the model with reality is verified. If this part is omitted, results of simulation may be incorrect. After approval, follows the third phase. It has a gradually character. Firstly, is carried out a simulation of previously created model. The main goal is to find dependencies between model's parameters and results of simulation. For this reason, model's properties are changed by analyst and he moves into next step. After making changes, the same model is examined. Simulation and modification process is repeated while mentioned goal is not achieve. When the most appropriate version of model was chosen, objectives and issues of the design task should be analysed again. The result of simulation is a dataset, which is used to making decision upon the examined business process.

In this paper, for modelling were used Business Process Modeling Notation (BPMN). It is overall accepted standard created for describing business processes. An idea on this notation has appeared in organisation called Object Management Group (OMG). It is a consortium, which participations are software vendors, customers, institutions of government and academic. Recent release of BPMN (version 2.0) was published in June 2010. The main goal of creating BPMN was to provide notation understandable for each kind of users. It should be clear and readable for business analysts, who create outline of processes, for employees, who are responsible to implementation of a designed process, and finally, for managers, who supervise the process [White S.A., 2011].

A process presented in this paper, was described by a collaboration global process. This is one of types of processes provided by BPMN (Fig. 1.).
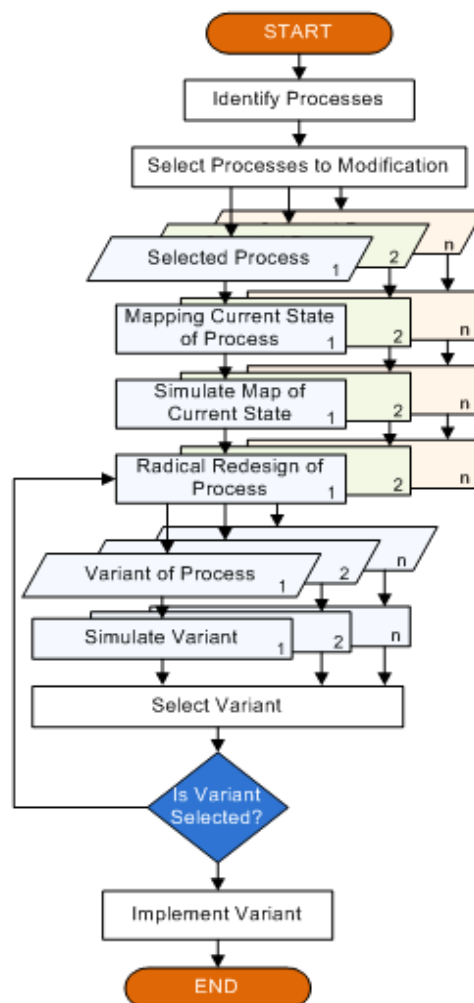

Fig.1. The modelling and simulation flowchart

A tool used in this paper

A tool that was used in this paper is integrated software. It was developed by iGrafx – a Division of Corel, Inc. iGrafx was created to improve modelling, analysis and advancement of business processes. Its main objective is to cause that these activities will be user-friendly, in particular for a members of teams which reorganize processes. The software is dedicated to create simple maps of processes that are located in small companies, as well as to mapping expanded business activities in large corporation. The software provides support assumptions of Lean Manufacturing and quality management - Six Sigma.

iGrafx consists with several applications, which differ in capabilities that are offered for users. In this paper was used iGrafx Process for SAP that provides possibilities such as modelling of business processes using BPMN and carrying out simulations of created models. This application allows designing all types of processes that may occur in BPMN [Lasek M., Otmianowski B., 2007].

Supply choice process

The process has several objectives. The main goal is to choose a supplier and buy needed materials. The supplier cannot be random or accidental. For this reason, an important issue is to make market research before complete a transaction. It is provides choice a supply from the best source and at an advantageous price. Moreover, the process should provide appropriate relationship between company and supplier. Design task is to analysis and modify the process. Purposes of the design task are to decrease of:

- mount of incomplete transactions to two per month;
- labour intensity of company management of at least 50%;
- process costs of at least 30%.

In relation to first purpose, keeping a low level of the incomplete transactions provides an opportunity to clear a backlog quickly, through overtime or an involvement of additional employees for a short time. Second purpose is associated with a general trend in the company that involves assigning of too many tasks for a senior staff. Since the tasks can be done by subordinates, a change of the process is justified. The last objective concerns reduction costs that are generated through the excessive participation of company management in the process.

The design tasks were realized in accordance with BPR assumptions. Due of used this approach, was possible rapid and radical achieved of the objectives.

In first phase, the current state map was created, which contain of process users, such as: Head of Production, Board Member for the Production, Head of Financial Department, Analyst of the Materials Market, Head of Supplies Department, Supplier. **The initial flow of the process was as follows:**

1. Head of Production notices a demand for materials and decide to order missing raw materials or semi-finished products;

2. Head of Production formulates The Notification for the Required Materials and passes The Notification on to Board Member for the Production;

3. Board Member for the Production, after receives The Notification, formulates The Financial Query, which concerns financial capabilities of the company, and next passes this query on to Head of Financial Department;

4. Head of Financial Department prepares needed information about the financial capabilities and passes The Financial Report on to Board Member for the Production;

5. Board Member for the Production checks a compliance of a demand of materials with the financial capabilities. If this is not approved, the Board Member generates The Report of The Incompatibility that is

passed on to Head of Production, who familiarizes oneself with the Report. Afterwards, the process returns to step 2;

6. If the compliance is approved, Board Member for the Production formulates The Guidelines for Market Research and passes them on to an appropriate Analyst;

7. Analyst of the Materials Market begins research of possible suppliers. It is embedded subprocess, which accomplishes the following substeps:

    a. Establishing the proper way of the research and choice a method of data analysis;

    b. Gathering a required information;

    c. Processing the information onto data that are useful to analysis;

    d. Data visualisation and analysis;

    e. Preparing The Report of the Materials Market Analysis, saving The Report in a report's database and passing it on to the company's management;

8. Board Member for the Production familiarizes oneself with the Report. It is a basis for a preparation of The List of Suppliers;

9. Board Member for the Production formulates The Request for Proposal, which is sent to suppliers from The List and next he waits for The Offer to Supply. At the same time, he puts The Request in the Internet.

10. After four days, Board Member for the Production chooses the most advantageous offer and passes The Supplier Data on to Head of Production;

11. Head of Production together with the Supplier negotiate terms of the transaction. This embedded process has substeps, which aims are to establish:

    a. a price and payment conditions;

    b. a quality of supplied products and materials which were used to manufacture the products;

    c. amount of the delivered goods;

    d. a delivery deadline and conditions of breaking the contract;

12. Supplier carries out the contract.

In this phase starts a process of maintaining an appropriate relationship with the Supplier. The process has a continuous character. Head of Supplies Department is responsible for it. The process concerns all suppliers who collaborate with the company and it relies on tightening economic and social ties with them. Taking care of the relationship may lead to negotiations of the contracts that are more beneficial to the company.

Process simulation and analysis of results

Due of the objectives of the design task, analysis and simulation do not include duration and costs of steps which are realised through the Supplier (formulate The Offer to Supply and contract realisation). Moreover, the tasks, which involve maintaining relationship between the company and sources of the supply, also are not included in analysis, because these are continuous processes that going on since passing The Request for Proposal on to suppliers. In the map, this situation is described in the form of a infinitive loop. It joins together swim lanes that belong to Head of Supplies Department and to the Supplier. Simulation was carried out by six month. Assumed, that demand for materials appears at least once per week (from 3 to 5 days after the last demand). The following tasks are bottlenecks of the process:

- preparing information about financial capabilities,

- analysis of a materials market,
- negotiations of a transaction conditions.

In the first case, time required for preparing The Financial Report through Head of Financial Department, is from 1 to 2 days. It is long enough, that during 6 months, queue of The Financial Query is still increasing, reaching a size of 21 unprepared financial reports at the end on this period. Due of this, the Board Member makes decisions about compliance of demand of materials with the financial capabilities without current data. In the second bottleneck, the Analyst prepares The Report of the Materials Market Analysis for too long. It lasts longer than preparing The Financial Report. Similarly in the last case wherein final shape of the contract is determined. For this reason, after simulation period only 7 transactions were finished. Places, where are generated the highest costs, are located in the tasks belonging to The Board Member and the heads of departments.

Variants of a modified process

In the **first variant,** competencies of Head of Production were increased. In this moment, he formulates The Financial Query, which is passed on to Head of Financial Department. In addition, he receives an answer and makes decision about the financial capabilities himself. In case of incompatibility, he revises The Notification for the Required Materials. Otherwise, he formulates The Guidelines for Market Research. Also, the Analyst has got more competencies. Besides carrying out the analysis, he generates The List of Suppliers. However, the largest increase was occurred in Head of Supplies Department. In opposite to previous users, the results of the simulation show a forming of bottlenecks in all tasks carried out by this user. Apart from negotiating, he must formulate The Request for Proposal and put it in the Internet. Moreover, the most beneficial supplier is chosen by him. This accumulation of the tasks is a reason of small amount of finished transactions. Only 5 of them were realised, and unfortunately, 18 got stuck in the Supplies Department. A positive fact is decrease of overall process costs. Total sum of process costs fall down from over 170000 zl, at the initial process flow, to circa 124000 zl in current version. The main reason of the drop is a withdrawal the Board Member and assigning his jobs to the heads of the departments.

Second variant assumes implementation of software for management of finance in the company. It is the module of ERP system, which makes easier management of company resources. Using this software, one bottleneck is relieved - Head of Financial Department devotes considerably less time to generate The Financial Report. The implementation and system maintenance are involved with added costs, however this investment pay for itself after some time. After simulation period, the Financial Department is the lowest costs generator. Improvement of this part of the process, causes creating of a queue during a carrying out the market research. This issue requires an individual improvement in the next variant. Furthermore, this version assumes engaging an additional worker of the Supplies Department. It provides relieving of the bottleneck in this part of the process. The extra employee formulates and passes The Request for Proposal on. Besides, he chooses an appropriate Supplier. The contract negotiations are left for Head of Supplies Department. Recruitment of additional staff causes increase of costs. Moreover these operations do not yield a radical improvement the amount of the realised transaction, because the negotiations' subprocess is still the bottleneck.

In the **third variant**, the process was improved to such a degree that total costs after simulation time are decreased to about 110000 zl, and process flow is devoid of all bottlenecks. The only place where the transactions are accumulated is the Department of Supplies. On average, one transaction per month is not finalized. This situation may be repaired rapidly through introducing overtime into the company, at the end of a month.

The improvement causes several changes in the process flow, compared with earlier variant. First of all, the ERP is used more effectively. The Head of Production do not have to formulate The Financial Query, because he has got an access to the system. He generates The Financial Report and makes decision about the financial capabilities himself. A new concept was applied also in the subprocess of market research. The bottleneck in this place was cleared by dint of a database of reports, which functioned earlier, but demand for using it, did not exist. The subprocess of materials' market research was also modified. At its beginning, the Analyst checks whether results of analysis of examined market segment are included in the database. If they do not exist, the process proceeds as previously. Otherwise, the Analyst updates the data, carries out the analysis and generates the report. After that, the report is saved in the database. Another change is an inclusion the negotiations' subprocess to competences of a Worker of Supplies Department. The maintenance of appropriate relationship was left for Head of this department. So far, he devoted for the negotiations nearly 100% of his time. After assigning another tasks for him, three new employees was engaged in this point. It causes increase the costs, which are incurred in the Supplies Department, but total process costs are lower. Furthermore, subprocess flow was changed. At the beginning, an employee checks whether company has collaborated with an analysed Supplier. If yes, the employee prepares contract alone. After approving the conditions through the Supplier, negotiations' process was skipped. If the company did not collaborate with the Supplier, or when he does not approve the contract, then appears a need of negotiations.
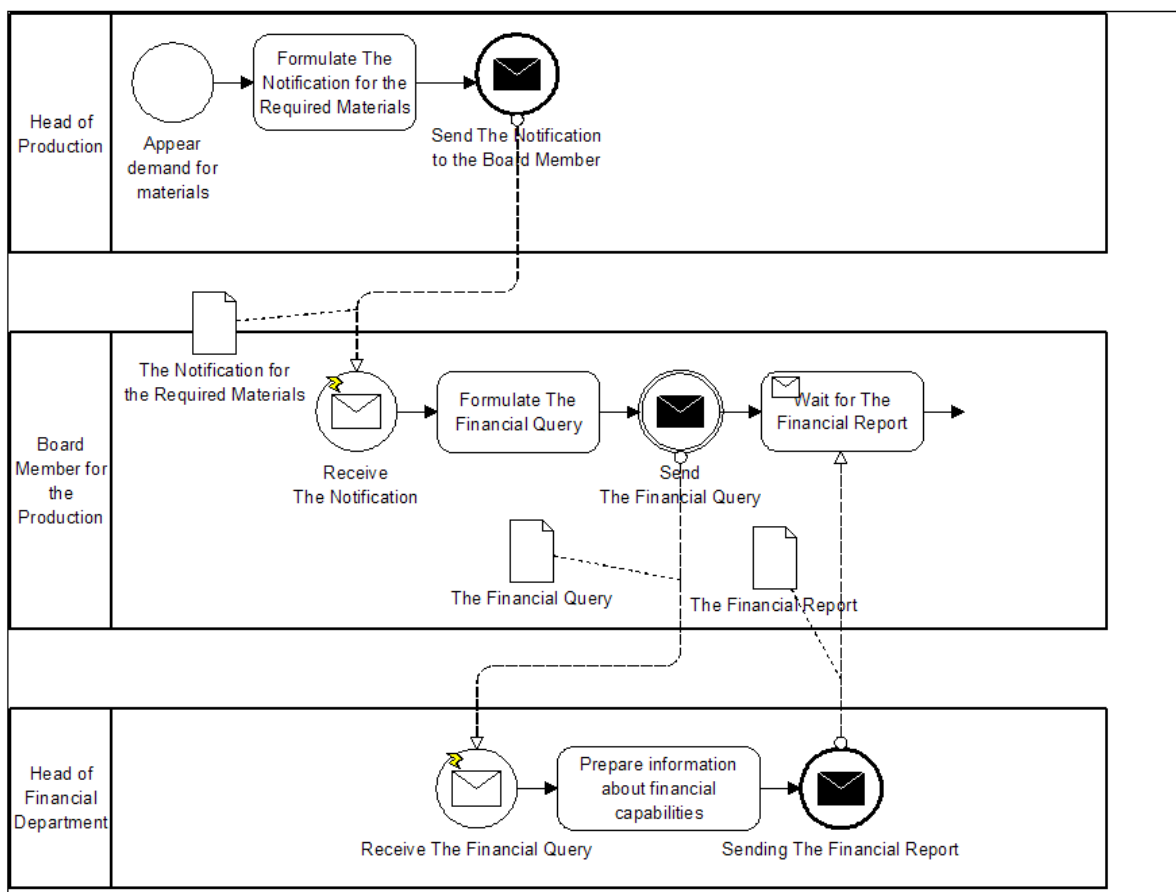

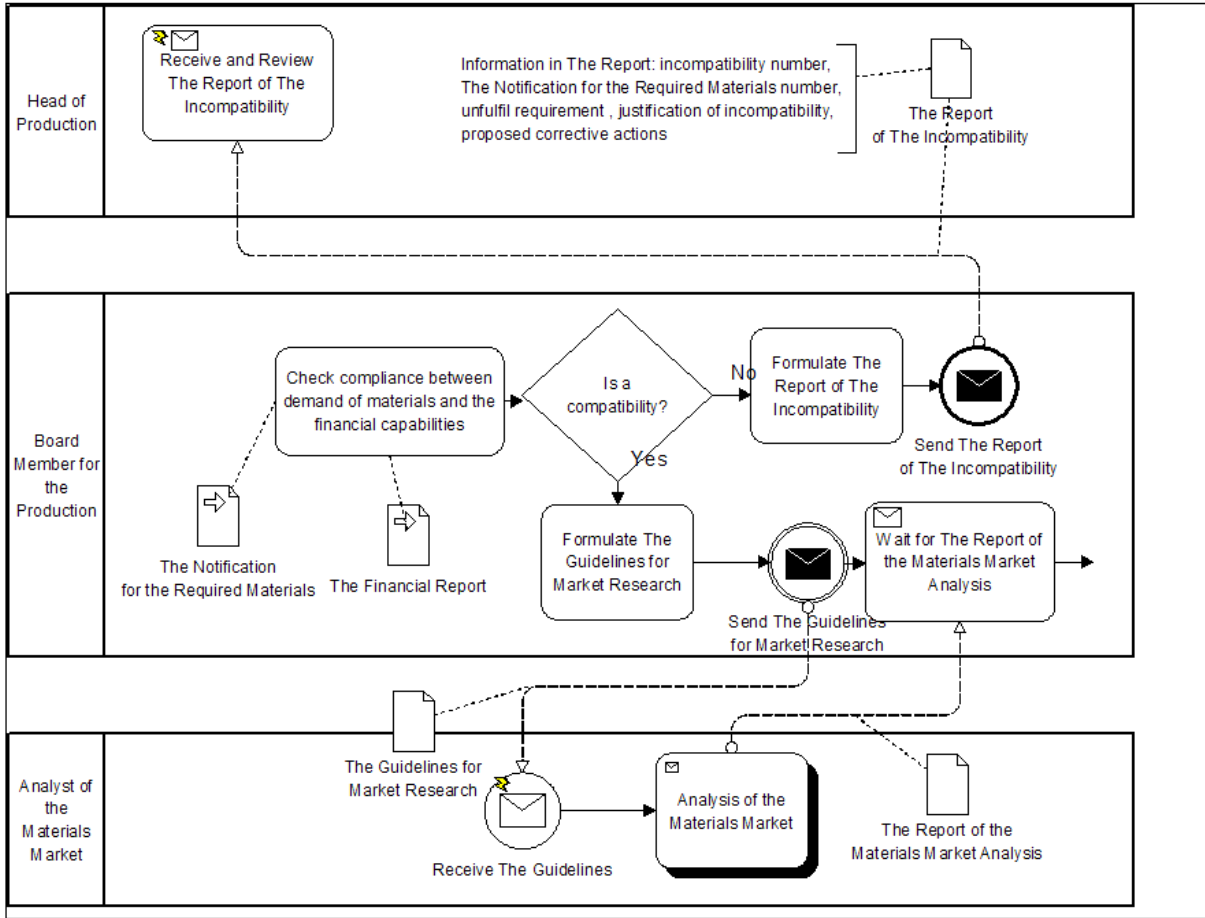*Fig. 2. The initial flow of the process – part 1*

Head of Production

Receive and Review The Report of The Incompatibility

Information in The Report: incompatibility number, The Notification for the Required Materials number, unfulfil requirement , justification of incompatibility, proposed corrective actions

The Report of The Incompatibility

Board Member for the Production

Check compliance between demand of materials and the financial capabilities

Is a compatibility?

No

Formulate The Report of The Incompatibility

Send The Report of The Incompatibility

Yes

The Notification for the Required Materials

The Financial Report

Formulate The Guidelines for Market Research

Send The Guidelines for Market Research

Wait for The Report of the Materials Market Analysis

Analyst of the Materials Market

The Guidelines for Market Research

Receive The Guidelines

Analysis of the Materials Market

The Report of the Materials Market Analysis

Fig.3. The initial flow of the process – part 2

Board Member for the Production

The List of Suppliers

The List of Suppliers

Rewiev the Report

Generate The List of Suppliers

Formulate The Request for Proposal

Send The Request

Wait for answers

Put The Request in the Internet

Collect answers

The Request for Proposal

Information in The Request for Proposal: product name, technical parameters, rules of the manufacturing (standards), ordered quantity.

Supplier

The Request for Proposal

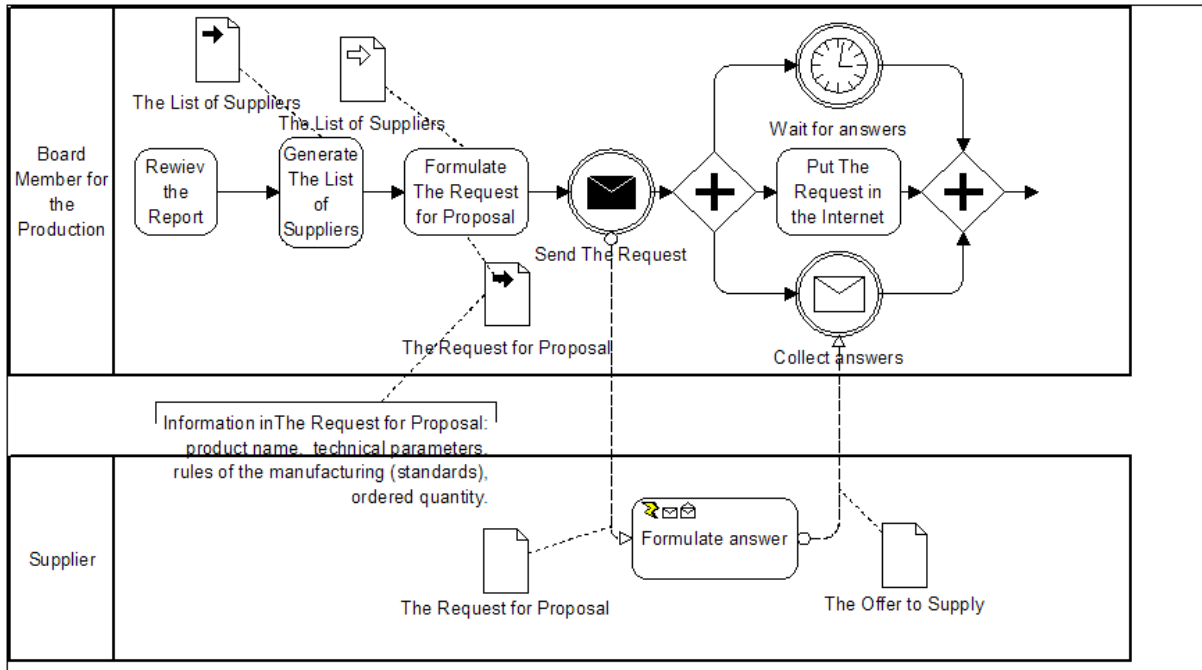Formulate answer

The Offer to Supply
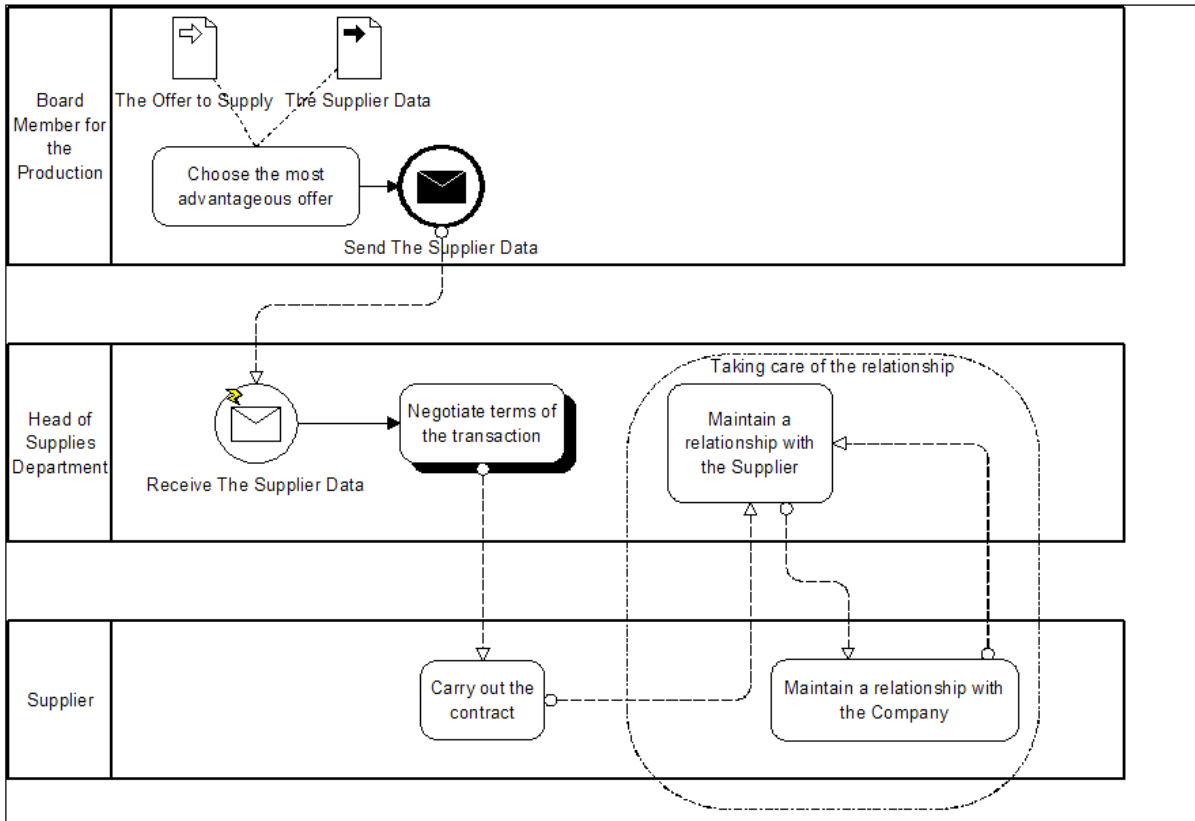
Fig.4. The initial flow of the process – part 3

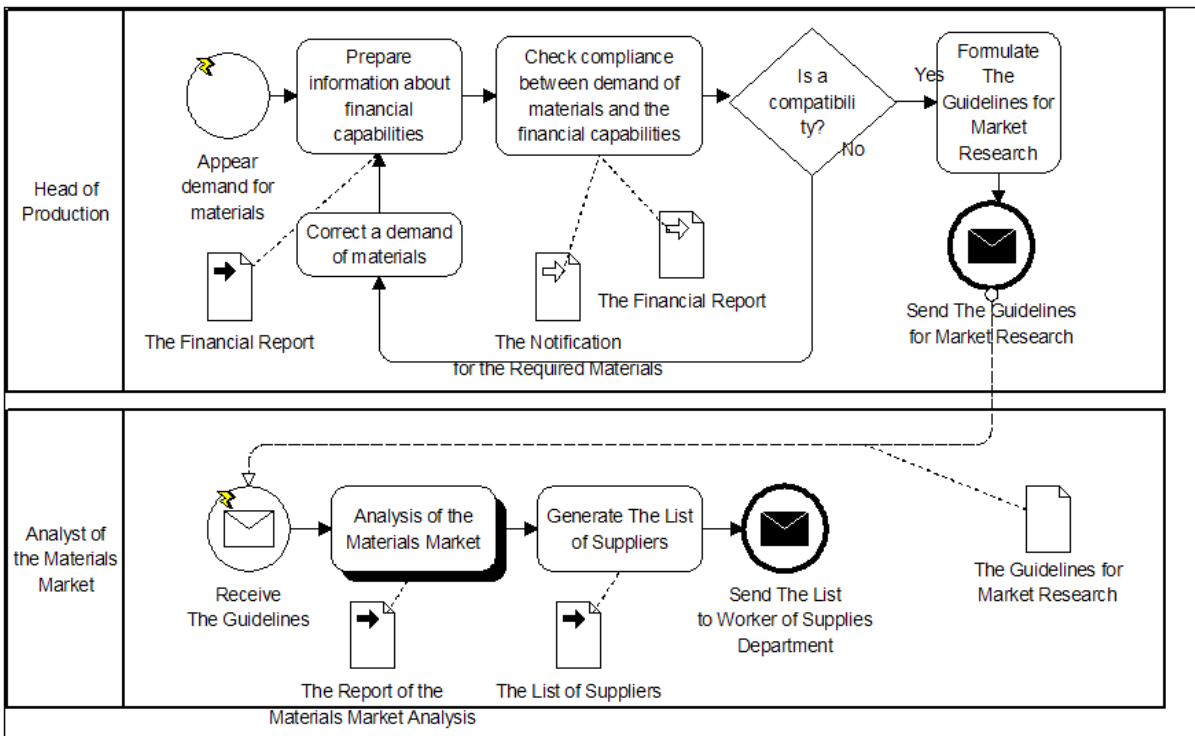*Fig.5. The initial flow of the process – part 4*

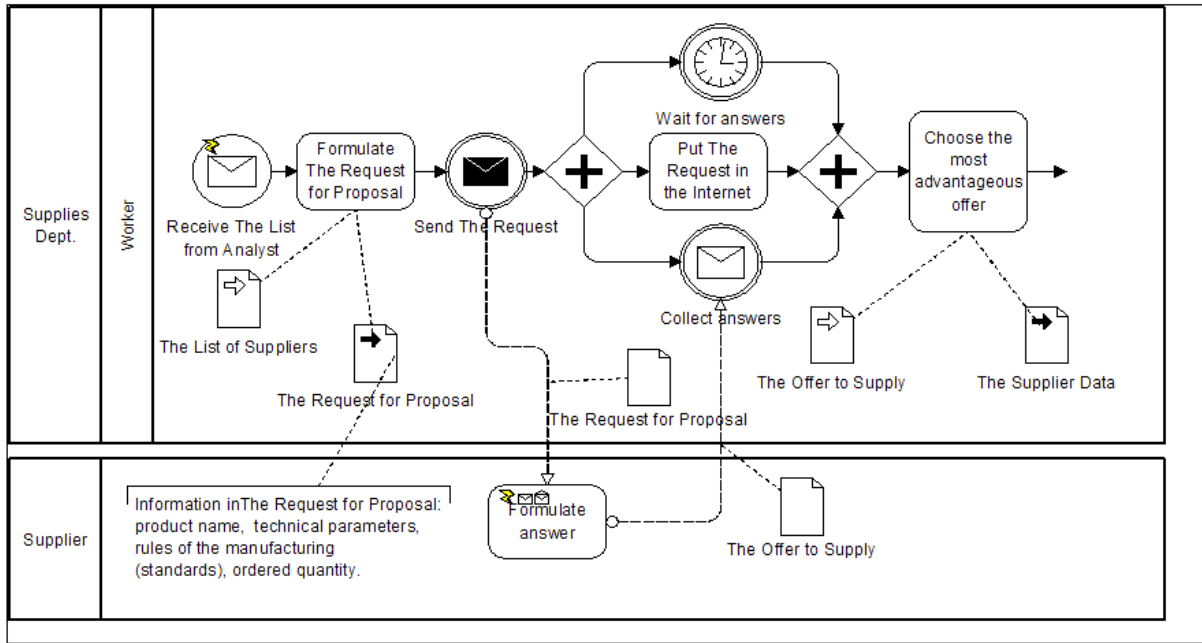*Fig. 6. The final flow of the process - part 1*
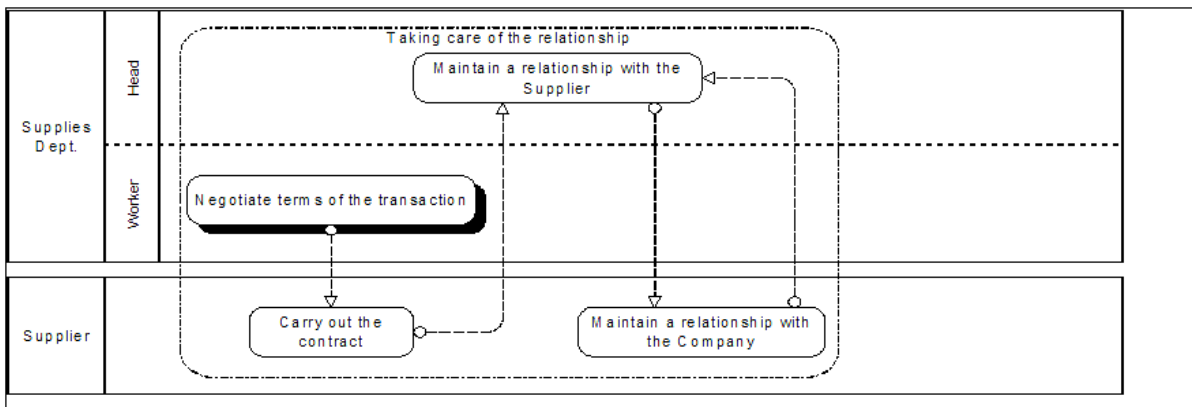
Fig. 7. The final flow of the process - part 2

Fig. 8. The final flow of the process - part 3

Conclusion and Future Work

Based on the results of the simulations conducted, third variant is regarded as the most appropriate solution. Achievement of all objectives was possible through changing of a concept of the analysed process. The new flow avoids involving two users, who participated in the initial flow of the process. There are: Board Member for the Production and Head of Financial Department. It provides to attainment of assumed decrease of:

- labour intensity of the Board Member – worker is excluded;
- total process costs – over 60%;
- amount of incomplete transactions – two per month.

While the versions of the process were created, several assumptions of BPR were used. Firstly, the ERP system was implemented. Using Information Technology is the main rule of restructuring modern companies. Currently, all institutions should use with technology achievements to be competitive and fulfil customers' needs. Another assumption is to increase executive ability of the staff. This involves with increase of responsibility all employees but on the other hand, for this reason they feel more appreciated in work. BPR gives employees lots of freedom during participation in the process. They have full information about the process and they must make decisions

alone. It causes that labour intensity of management staff may be reduced. This is one of the most revolutionary postulates of BPR.

Achievement of the aims was strongly supported through iGrafx. This software has mechanisms to facilitate mapping of processes. Due of this fact, modelling becomes rapid and user-friendly. In addition, it allows to simulating of created maps. The software shows several kinds of results such as: costs, bottlenecks, amount of finished transactions. The results are generated for each task, process user and finally for overall process. They are available both in numerical and graphical form.

Process-oriented companies have still the advantage over the other. Moreover, a term 'process-oriented' is identical with 'customer-oriented'. Due of that, companies which adopt BPR assumptions have chance to improve effectiveness and quality of customer service. In addition, the Reengineering can be implemented in various kinds of institutions. Importance of BPR and orientation on the processes is still grows. As a result of this, importance of modelling and simulation using computer tools is also higher. For this reasons, issues described in this paper can be develop in future.

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Authors' Information

Łukasz Paśko – *Graduate Rzeszow University of Technology, Department of Computer Science, The Faculty of Mechanical Engineering and Aeronautics Rzeszow University of Technogy, Powstancow Warszawy ave. 8, 35-959 Rzeszow, Poland;*
e-mail: lukasz.pasko48@gmail.com