Algorithm for business process reengineering in industrial enterprises

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Abstract. The present article delivers an analysis of the specific stages of reengineering implementation according to reengineering proponents and examines the strengths and limitations of the methodology developed by them. The analysis of the outlined stages of business process reengineering provides a detailed sequence of the stages of reengineering project implementation. The algorithm for business process reengineering is depicted in a block diagram which presents the summarized conceptual and structural components and the logical connections between the distinct steps of business process reengineering methodology which includes seven stages: initiative for business process reengineering; diagnostics of existing business processes; business process redesign; implementation of redesigned business processes; summary and evaluation of business process reengineering efficiency; analysis and regulation.

1. Introduction
Considerable structural changes in the industrial enterprise in the course of reengineering – fundamental and revolutionary BP (business process) restructuring coupled with transition to the new principles of enterprise building call for a special project development and implementation as well as creation of reengineering team including both enterprise staff members and invited consultants. After accomplishing the project goals and objectives, the enterprise is supposed to transition to a new stage of development called business enhancement involving slight modernization in the course of the ongoing work.

Reengineering implementation is indispensable even after the possibilities for gradual improvement have been exhausted, but in this case the project is only intended for particular subdivisions of the industrial enterprise. Thus, the continuous modification activities become part of the enterprise everyday life as a reaction of the ever-changing external environment factors: market, technologies, customer preferences, competition, etc.
2. Exposition

Different reengineering methodologies are available. The strengths and limitations of Hammer and Champi’s, Davenport’s, Manganelli and Klein’s and Kodak’s methodologies are surveyed on the basis of an analysis of the particular stages of BPR execution [1].

According to Hammer and Champi, the goal of the reengineering process lies in dramatic increase of business process efficiency and the tool for achieving it is creation and implementation of original, ‘irrational’ ideas capable not only of improving the process, but of completely overhauling it. In this case, information technologies play an important, but not a key role. In his work, Hammer [2] argues that excessive fascination with IT is what can cause the reengineering project to be merely reduced to automation of all business process stages.

The lack of a specific project time frame can be deemed a limitation of the proposed methodology. On one hand, if the ideas are conceptualized and do not raise doubts, then project success is more than likely guaranteed and its implementation deadline is short enough. On the other hand, if ideas turn out to be not revolutionary enough and the proposed model – unviable, then it is necessary to invest additional efforts into conceptualisation and validation of new ideas.

According to Davenport the goal of the reengineering process lies in dramatic increase of business process efficiency and the tool for achieving it is implementation of new IT although Davenport recognizes the great significance of organisational and staffing issues.

According to Davenport, culture may appear as a grave hindrance in case innovative processes do not fit the cultural environment. With regard to management, Davenport focuses on traditional functions such as planning, leading, management, control, decision-making and communication [3, 4]. Unlike Hammer, Davenport views the reengineering project as part of a package of measures intended to improve industrial organisation including other unrevolutionary approaches, such as TQM [4, 5] rather than as a single activity. In respect to this, activity efficiency analysis is made on a continual basis.

Davenport’s methodology presupposes detailed description of existing business processes – for large enough organization description takes from six to nine months. On one hand, detailed description reveals where major issues lie, but on the other hand, such an approach only presupposes correction of existing errors and solution of existing problems rather than process reconceptualisation. The focus on IT, on one hand, significantly streamlines tasks for reconceptualisation presupposes increased awareness of the ways in which implementation of new IT will affect processes. On the other hand, problems often lie in process logic itself rather than in insufficient automation.

According to Manganelli and Klein the goal of the reengineering project lies in dramatic increase of competitiveness and the tool for its achievement is implementation of new IT.

Manganelli and Klein’s approach differs considerably from Hammer and Champy’s and Davenport’s approaches. Reengineering proponents also consider increase of competitiveness, but what they focus on in fact is increase of BP efficiency only [6]. Competitiveness is above all based on unique competitive advantages of industrial enterprise products and services. Achievement of a particular competitive advantage is what underlies industrial enterprise strategy. The lack of strategy validation in BP redesign causes the reengineering project to only increase efficiency i.e. reduce costs, time, increase customer satisfaction rate rather than contribute to the creation of unique competitive advantages. Strategy validation can result in substantially different processes.

According to Kodak, the goal of the reengineering process lies in fundamental increase of efficiency and the instrument for its accomplishment is implementation of new IT.

The main strength of Kodak’s approach is a clearly designed system for project administration. The focus of methodology founders is rather on IT implementation than on development of ‘irrational’ reengineering ideas.

The algorithm for BPR depicted in figure 1 below in the form of a summarized block diagram is based on Hammer and Champi’s approach and considers the need for relation to enterprise strategy
proposed by Manganelli and Klein. The algorithm has been developed on the basis of practical expertise of enterprises which have carried out reengineering.

![Figure 1. Block diagram of BPR methodology](image)

The summarized block diagram of the proposed methodology for BPR represents the summarized conceptual and structural components and the logical connections between the distinct steps of the methodology including the following stages: initiative for BPR; diagnostics of existing business processes; business process redesign; implementation of redesigned business processes; summary and evaluation of BP efficiency; analysis; and regulation.

**Stage: 1. Initiative for business process reengineering**

In this stage, the BPR project is launched. Project launch timing is pivotal to the successful accomplishment of its goals and objectives. The sequence of the activities included in this stage is as follows:

- 1.1. Creation of BPR management system.
- 1.1.1. Selection of participants in BPR.
1.1.2. Allocation of roles and responsibilities.
1.1.3. Team work organisation.
1.2. Planning of BPR execution.
1.2.1. Scheduling.
1.2.2. Selection of implementation methods and tools.

Team initiates action by selecting the methodology used in reengineering.
1.2.3. Selection of interaction tools.

The first stage appears essential to the success of BPR, but also extremely difficult due to an emerging inconsistency – on one hand, BPR is launched, project team is built, research work is initiated, but final outcome is not yet clear. Diagnostics can reveal that project launch timing is not right.

Stage: 2. Diagnostics of existing business processes

Different authors evaluate the stage of diagnostics of existing business processes in different ways. Davenport proposes detailed description of existing business processes [7], while Hammer suggests that no efforts at all should be wasted on description [8]. What is deemed reasonable is an intermediate approach. A design concept can be developed without description of processes. As a result, however, it will appear too general – fit for preliminary discussion, but not for actual implementation. Wasting too much time on description of processes subject to radical overhaul is inexpedient. It is recommended that stage 2 – diagnostics of existing business processes should include the following activities:

2.1. Description of existing business processes.

Once reengineering project launch is scheduled, it is necessary to create a process map at the highest possible level. Selection of processes which will be subject to reengineering presupposes an awareness of the processes which are currently ongoing in the enterprise. This is by no means an easy task for enterprises built on the basis of functional criterion. Processes are most often not identified, but scattered as distinct functions among different enterprise subdivisions. In case a single approach for process selection is not available, the task appears complicated even to experts dealing with the process approach.

It is necessary to select key (priority) processes which will undergo reengineering. Key factors for success (7-8 factors) such as duration, costs, after sales service, etc. are also determined. The number of processes depends on the quantitative composition of the project team and the prospective investments.

The description of existing business processes includes:

2.1.1. Creation of a summarized business model and identification of the most essential processes by means of expert evaluation such:
• processes which have greatest impact on customers;
• processes which have lowest efficiency in comparison with analogous (similar) processes in leading companies;
• processes the reengineering of which can yield positive future results. Processes are to be arranged in order of importance.

2.1.2. Distinct processes require high-level description.

Prototype building is an instance of high-level description of future processes. Consequences (forecasting of changes in process characteristics) are evaluated; both success and risk factors are determined.

2.1.3. Indicators (measurable properties) are measured:
• time indicators – average order processing time, productivity, etc.
• cost-efficiency indicators – prices of goods, number of participants in the process, etc.
• quality indicators – rejecton rate (customer refusals), level of service provided, etc.

A description of enterprise organisational structure is made.
2.2. Analysis of customer, supplier and partner requirements which comprises:

- 2.2.1. Customer requirement analysis made on the basis of surveys, interviews, market research. It involves:
  - classification of existing and potential customers;
  - a list of requirements which are met/not met by BP;
  - a description of the ideal (from customer point of view) BP;
  - customer evaluation of existing business processes through the use of indicators.

- 2.2.2. Partner and/or supplier requirement analysis which encompasses:
  - evaluation of their roles in BP;
  - requirements for ideal partners and/or suppliers;
  - partner and/or supplier requirements for BP.

2.3. Evaluation of enterprise level.

Evaluation of enterprise level is carried out by drawing a comparison between the particular enterprise and the best competitor organisations which:
- have high sales volumes;
- boast good reputation;
- produce high-quality goods.

Comparison is executed by means of indicators.

Enterprise level evaluation allows for identification of enterprise strengths and weaknesses in comparison with competitors.

2.4. BPR goal setting.

Specific project goals are set on the basis of results of customer, partner and supplier requirement analysis and enterprise level evaluation.

Goals are to include indicator values.

2.5. Documenting and verification.

Stage: 3. BP redesign

In this stage it is expedient to again adopt a mixed approach involving BP redesign, defiance against old rules, and employment of ‘revolutionary ideas’ along with the widest possible application of IT capabilities.

Scenario planning of BP redesign involves goal achievement strategy development. Methods of expert evaluation can be employed in scenario efficiency evaluation. BP redesign plans are generally created by project teams. It is necessary that all process activities should be simulated by means of imitation models prior to actual redesign process.

The sequence of the activities included in the stage of BP redesign is as follows:

- 3.1. Creation of existing business process model ‘as it is’.

Initially, a model of the existing business process ‘as it is’ is created. Once the model is developed and trialed, its adequacy is verified. The model allows for identification of ‘impediments’ and evaluation of key parameters.

- 3.1.1. Creation of external model which includes participant selection and description of interactions (diagram).
- 3.1.2. Event flow description by means of IDEF0 diagrams, workflow diagrams, Gantt diagrams, simulation (imitation) models, etc.
- 3.1.3. Creation of external model which includes object selection and diagram representation and interaction representation (diagrams of sequence or collaboration).
- 3.1.4. Documenting and verification – discussion of created model for the purpose of error identification, documenting and verification.

- 3.2. Analysis of existing BP model.

The analysis of existing BP model involves:

- 3.2.1. Measure and evaluation of BP indicators.

Process characteristics are measured through the use of indicators:
• value – techniques of functional-value analysis
• time – scheduling techniques (Gantt chart, network diagrams) and simulation modelling;
• quality – expert evaluations (quality points).

➢ 3.2.2. Identification of problems and limitations – on the basis of measurement of BP quality attributes, evaluation of BP steps, as well as staff interviews and analysis of existing information systems.

The problem list is to be organized in a descending order of importance.

➢ 3.2.3. Correction of BPR goals outlined in the stage of existing BP diagnostics.

The following step is creation of new BP model (what it is supposed to be like) which involves establishment of new organisational structure and new information system should the need arise.

➢ 3.3. Creation of new BP model (what it is supposed to be like).

The creation of new BP model encompasses the following activities:

➢ 3.3.1. Development of innovative ideas.
➢ 3.3.2. Development of alternatives (further options).

Innovative ideas are considered in the process of specification of summarized scenarios (from goal specification). Reengineering principles are to be considered in scenario development process.

➢ 3.3.3. Creation of discrete models for each of the alternatives.

Future process design is created by reengineering project team by means of tools for process modelling. The procedure entails the same activities as the ones involved in the process of creation of existing BP model.

➢ 3.3.4. Analysis of discrete models of alternatives and selection of the best option.

Discrete models of alternatives are compared to one another as well as to existing BP.

As a final step, it is necessary to establish whether the measurable goals and objectives set in the diagnostic stage are accomplished.

Stage: 4. Implementation of redesigned BP

In the stage of redesigned BP implementation it is reasonable to apply Hammer’s three-phase implementation strategy which includes laboratory, pilot and circulation phase.

Laboratory stage involves simulation of a number of process models and verification of hypothesis viability.

Pilot testing involves launching a number of processes in ‘real-life’ environment, but within a limited range, i.e. trial run.

Circulation phase involves process launch on a large-scale basis within the particular enterprise.

The sequence of the implementation stage activities is as follows:

➢ 4.1. Verification of new BP which includes:
    ➢ 4.1.1. Verification of new BP model.
    ➢ 4.1.2. Verification of information maintenance system prototype.
    ➢ 4.1.3. Trial run of integral business model on a small-scale basis within the particular enterprise.

Trial run is better conducted by employing prototypes. Certain alterations and model specifications can be made on the basis of trial run results.

➢ 4.2. New BP implementation.

As new business processes are implemented, it is necessary that existing processes continue functioning. Customers and partners are not supposed to feel uneasiness during integration of new processes in old ones.
A universal application method which would be feasible for each and every project is not available. Economic, political and cultural idiosyncrasies of the particular industrial enterprise are to be considered in the process of selection and rational combination of different events. Among the most determining factors are:

- total amount of reorganisation work;
- number of engaged employees;
- number and significance of affected processes;
- scale of change (revolution or evolution);
- statutory deadlines;
- prevailing management style.

**Stage: 5. Summary and evaluation of business process reengineering efficiency**

The main activities in this stage are:

- **5.1. Project summary.**
- **5.2. Evaluation of project efficiency.**

Following implementation BP is to be under continuous supervision and control for the purpose of obtaining statistical data on actual progress and outcome of executed activities and customer satisfaction. Comparison between planned performance and reported performance is drawn in order to identify possible deviations. Derived data allows for BP measurement in accordance with target criteria and indicators. In case of possible deviations, two more stages are to be considered – analysis and regulation.

**Stage: 6. Analysis**

This stage involves examining and analysing reasons for deviation occurrences and outlining respective solutions to eliminating them. The aforementioned components of the efficiency diagnostics on the basis of suggested factors can be used for this purpose.

**Stage: 7. Regulation**

In this stage, should need arise corrective action plan is developed on the basis of monitoring results. In accordance with it BP model and respectively the ongoing (real) process undergo overhaul. Regulation continues until equilibrium is fully restored.

BPR presented above has been trialed in Bulgarian industrial enterprises. Business process redesign has led to positive outcomes. Reengineering of ‘sales and customer service’ process in one of the enterprises has resulted in reduction of process cycle time by about 2/3 on average. The main project goal has been accomplished – the number of accepted purchase orders has risen by 50% and sales revenue – by 20%; the number of points of contact has been reduced; the roles and participants in the process; the number of error occurrences in information conveyance and reflection has been reduced which has in turn contributed to achieving information coherence and consistency; the opportunity for system update and improvement has been exploited.

**3. Conclusion**

What is specific of the reengineering approach is that it offers new models for organisation, management, planning and execution of processes, functions, activities and tasks. It is based on the integration of simple and elementary operations into a single integral process. The synergy between reengineering and modern information technologies can serve for analysis and optimisation of organisational structure, staff reduction, cycle time reduction, improvement of BP quality, new customer attraction and cost saving. Successful implementation of reengineering projects involves considerably greater efforts by comparison with implementation of technical aspects of new decisions.

Reengineering projects are unique, ‘know-how’ projects in the sense that they consider specific enterprise peculiarities which accounts for the development of a special project for each particular enterprise. It is practically impossible and therefore unnecessary to provide for all design details. What
is essential is the fact that BPR methodology reveals goals and provides guidelines on their accomplishment. Enterprises which have launched reengineering can use methodology components, introduce certain corrections justified by production specifics which gives reengineering team opportunity for creative work and enables them to develop their own reengineering projects with minimal time and labour costs.

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