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Holistic Methodology for Business Process Reengineering

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Abstract

This paper describes a holistic methodology for business process reengineering. The methodology provides a standard flow model for reengineering, figure models which visualize the interactions in the business process to find hidden problems, and algorithms to evaluate and predict the quantitative results. Many conventional ideas based on thinking process are extended and integrated in the presented method. They include the theory of constraints, the unified modeling language, the design structure matrix, and a business process simulation technique. The methodology is currently validated for a number of different examples such as manufacturing preparation processes and car software implementation.

Keywords

Business Process Reengineering, Product and Production Development, Theory of Constraints, Design Structure Matrix, Unified Modelling Language, Total Quality Management

INTRODUCTION

The modern manufacturing enterprise requires continuous improvement to compete in the global market. There are four different management targets: top management such as resource allocation, management quality such as reinforcing management ability, knowledge management such as sharing engineering data, and business process reengineering such as lead time reduction, quality improvement, and balancing of the workload.

This paper describes a holistic methodology for business process reengineering. A frequent problem encountered in the business process reengineering is to motivate other employees and managers. They often want to have a prediction of the performance improvement after the reengineering. Another difficulty lies on the misuse of the methodology employed by non experts for the reengineering. A holistic method is a key to solve many of these problems.

The methodology provides a standard flow model for reengineering, figure models to visualize the interactions in the business process to find hidden problems, and algorithms to evaluate and predict the quantitative results. The flow model is designed for those unfamiliar with the business reengineering. Section 2 describes the basic idea of the reengineering flow. Many conventional ideas based on thinking process are extended and integrated in the presented method. They include the theory of constraints (TOC) [1], the unified modeling language (UML) [2], the design structure matrix (DSM) [3], and a business process simulation technique, referred as to DPS. The combination of the reality tree in TOC and the business process description under UML is one of keys to visualize true problems in systems. Section 3 describes the combinatorial idea in detail. Though there are commercial products [4] with business process simulation [5], the DPS features a critical path analysis in combination with a bottleneck analysis for the abilities of the resources. The DSM and the DPS evaluate the business processs in terms of the performance as given in Section 4.

The methodology is currently validated for a number of different examples such as manufacturing preparation processes and car software implementation. The paper provides the findings from the experiments in Section 5. The conclusion is described in Section 6.

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REENGINEERING PROCESS FLOW MODEL

The methodology deals with two different flow models: one that is designed to visualize the business process itself, while the other is to provide a standard reengineering process for a business process. This section focuses on the reengineering process. The basic reengineering steps are proposed as follows:
Step1: Definition of the aim and the goal for the reengineering
Step2: Visualization of the correlations
Step3: Analysis of the correlations
Step4: Change of the correlations in order to achieve leanness.
Step5: Verification of the leanness
The correlations can be based on various types of relations between physical components and the entire system, design specifications and the functions, human skills and the requirements, divisions and the responsibilities, and the activity goals and the process requirement. The figure model is illustrated in Figure 1.

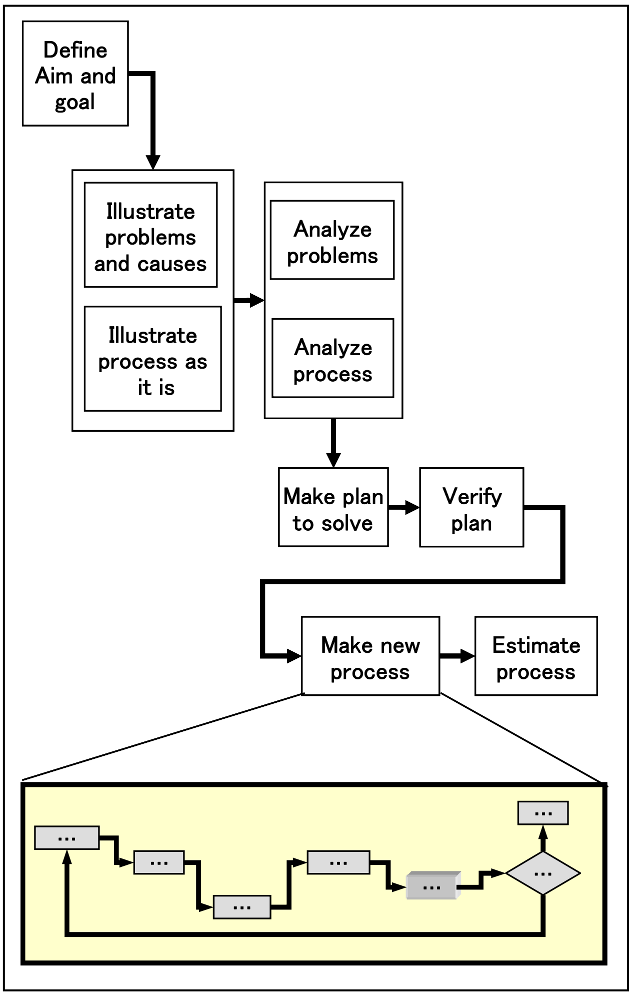

Figure 1. Figure Model of Reengineering Process

VISUALIZATION OF CORRELATIONS

Many engineers utilize illustrated business process flows to find core problems. Some cases fail because the description is too rough to find problems, while others fail because there is too much detail to understand the core problem, in paticular, when many different divisions are involved. An appropriate method is needed to focus on the key issues and to reduce the efforts to illustrate the flows.

Therefore, a figure model is needed to digest the problems by using a cause-effect relationship graph. However, the figure model alone is insufficient if many people participate but nobody understands the entire system. In addition, the figure model may have shortcomings about the approach for improving the process after the problem detection. Therefore, this paper proposes to illustrate the business process flow and the cause-problem relationship figure in paralell and improve them simultaneously. Figure 2 illustrates the idea.

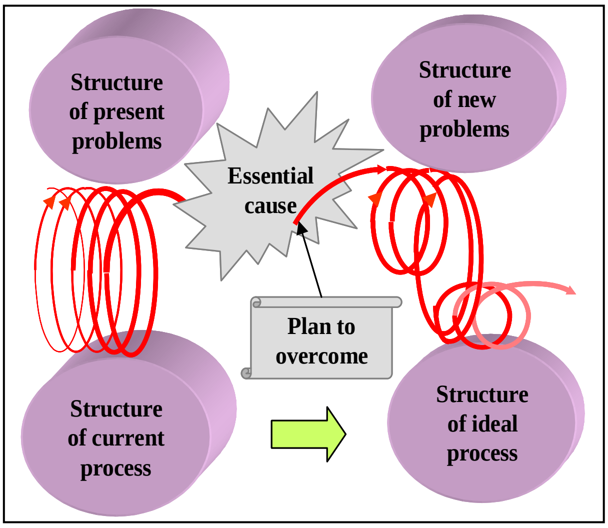

Figure 2. Simultaneous improvement of Thinking Process for Visualization

It is important to select the appropriate figure models from the many conventional studies. The reality tree in the TOC[1] was chosen for the cause-problem relationship figure model and the Eriksson-Penker (EP) business extension on UML for the business process figure model. The EP method is improved by adding the columns describing goals, aims, responsible persons or divisions, and problems which have links to activities in the business process to adjust the proposed methodology. Figure 3 visualizes how the columns in the process figure originate from the cause-problem relationship figure model.

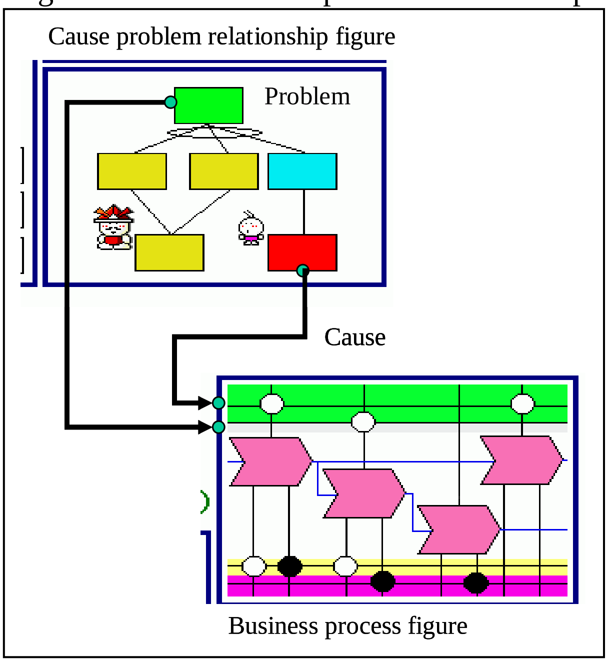

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Figure 3. Cause-Problem Relation figure and Business Process figure

The reality tree is chosen to reduce the complexity of the problems to be solved in the process flow figure because the underlying idea in the TOC is to find the primary bottleneck in the system.

EVALUATION OF PROCESS

The problems in the business process reengineering process are often caused by unawareness or misunderstandings about the deliverables, activities, and the due dates in other divisions. The proposed methodology focuses to rearrange the order of the activities as described in Section 4.1 and find the bottleneck in terms of system performance by using a simulator as described in Section 4.2.

Process Structure Matrix

The process structure matrix is based on the design structure matrix. The process structure matrix may include not only design activities but also business process activities as shown in Figure 4.

		Cause						
		Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7
Result	Activity 1	■					○	
	Activity 2		■		○			
	Activity 3	○		■				
	Activity 4		○		■	○		
	Activity 5	○				■	○	
	Activity 6		○	○			■	
	Activity 7					○		■

Figure 4. Process Structure Matrix

The order of the activities is shown by circle marks in the table. The marks in the right-upper triangular area represent the possibility of the return paths in the case of a failure. A larger distance of the marks from the orthogonal line indicates a longer return paths. The proposed methodology provides an optimization algorithm to rearrange the process to minimize the lead time. To reduce the lead time, the calculation recommends to relax the constraints for the process order by defining standard specification, changing the work sequence, or arranging appropriate meetings to avoid unawareness and misunderstandings before they become problems. The optimization algorithm is described in detail in [5]. Documenting all activities and their relation within a large project is not easy. Therefore the activities are specified in the business process figure as described in Section 3. The matrix and the process flow are improved simultaneously by mutually checking errors.

Process Simulation

A new algorithm was developed to analyze and optimize the business process based on the process structure matrix with respect to the entire system performance. Figure 5 shows an example of a simulation model. The simulation model includes tasks to be performed, workers which perform tasks, and skills which workers must possess in order to perform certain tasks. The simulator deals with uncertainty for different human skills to different activities. The simulator includes a sophisticated bottelenck detection method that not only finds the bottlenecks in the workers but also determines the critical bottleneck skills that build up the critical chain. Only a single simulation is needed to analyze the system.The technique is described in detail in [6]. The components in the simulation model can be defined in either the process figure or the process structure matrix.

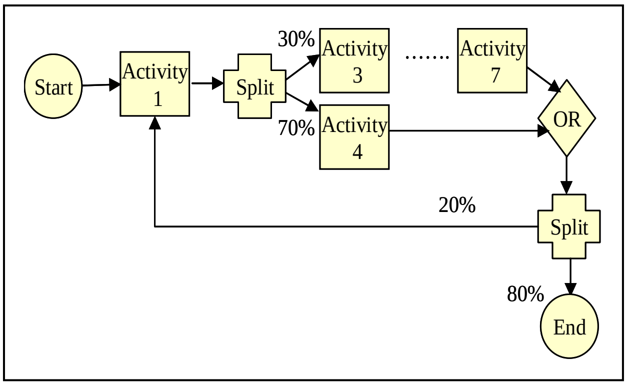

Figure 5. Process Simulator

EXPERIMENT

The methodology is currently validated for a number of different examples. These examples are categorized as new processes, variant processes, and invariant processes. The new processes represent new business environments in which the analyzed enterprise has no previous experience. The category includes the research and development of newly invented products, implementation of new systems and research of new business fields. It is desired to find the problem that has the largest influence on the goal and to create an appropriate thinking process specific for the company but application neutral .

The variant process is periodically performed in order to acqired a reasonable and standard process flow based on experience. But the changes in the products and services cause the process sequence to differ from the previous sequence. Several activities may be added to or eliminated from the basic flow. The category includes manufacturing preparation processes and software implementation in the car industry. Problems in the category are often caused by inappropriate standards or inappropriate parallel developments, lacking sufficient exchange of information.

The invariant process has fixed sequences but the contents vary with the process. The category includes accounting, checking of documents, and monitoring of facilities. Common problems related to the category are the estimation of the appropriate costs due to the tasks that are outsourced to outside companies.

The different types of processes require different figure models to improve the processes. Figure 6 shows which models are used for the different application types.

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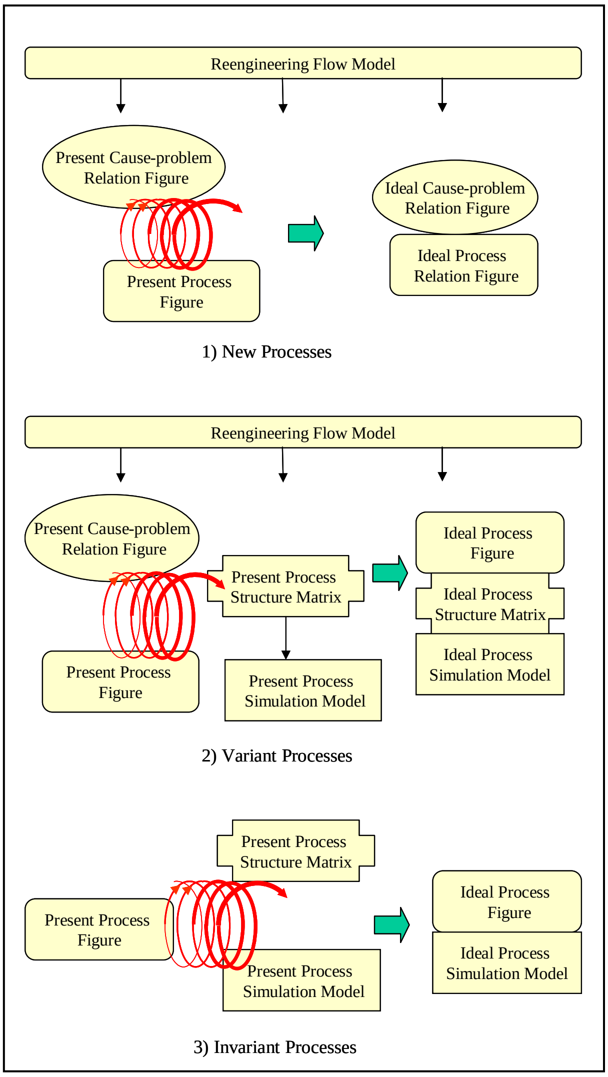

Figure 6. Different Models in Different Types of Applications

CONCLUSIONS

The paper proposes a holistic approach to analyse cause-effect relationship in business processes and provides a number of ideas for reengineering. Based on a number of experiments the applications for reengineering are categorised into three groups that requires different figure models and methods.

The experiments suggest that the most important future research includes the development of a method that improves the support of and involves the people related to the reengineering before starting reengineering projects though the proposed methodology.

ACKNOWLEDGEMENTS

We would like thank Mr. Inamori and Mr. Wada in Toyota Central R&D Labs. for the collaboration. We also appreciate the help of the staff of the Toyota Group companies with suggestions and discussions. We want to thank especially Mr. Hayama and Mr. Ochiai of Toyota Motor Co.

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BIOGRAPHY

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