BUSINESS PROCESS TRANSFORMATION PATTERNS & THE BUSINESS PROCESS TRANSFORMATION WIZARD

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ABSTRACT

In spite of many advances in business process simulation technologies, their adoption by the business analyst community has been primarily limited to specialists. We propose a Business Process Transformation Wizard as a capability to bridge this gap. This enables analysts to explore different business process transformation options using Business Process Transformation patterns and analyze their performance using quantitative technologies. In this paper, we explain the approach encapsulated in the BPT Wizard and illustrate it with an example.

1 INTRODUCTION

Business process modeling is a technology aimed at modeling business processes and analyzing them with the objective of using the analyses to drive process transformations. Business process modeling tools have underlying capabilities such as simulation that helps business analysts to understand and quantify the impact of different process transformations on process Key Performance Indicators (KPIs). Even though business process modeling is widely used, analytic capabilities such as simulation are used to a much lesser degree because developing and running simulation models and interpreting their results is seen as a complicated activity by a majority of business analysts. As a result, many business analysts consider such tools as only suitable for experts in the field and are hampered in unlocking the full potential of business process modeling for identifying and assessing business process transformation options. Hence, there is a need for researching approaches that enable business analysts to use quantitative analysis methods easily towards the overall objective of business process transformation.

Our approach fills the gap in business analyst requirements by encapsulating the methodology that an expert would use in developing and interpreting analysis models such as simulation models. The Business Process Transformation Wizard (BPTW) guides business analysts in specifying data that is required for the analysis and also interprets the results to deliver business insights. Furthermore, the BPTW can also encapsulate knowledge by identifying the process patterns where specific transformation patterns are most suitable, so that this knowledge can be leveraged in other situations to identify appropriate business process transformation options.

The reader can get an overview of different aspects of business process modeling and design in Laguna and Marklund (2004). The concept of patterns has been used earlier in workflow design (Thom and Iochpe 2004; Russell et al. 2005; Gaaloul, Baina, and Godart 2005). Thom and Iochpe (2004) integrate a pattern catalogue in a business process model that enables creation of business sub-processes from the reuse of structural business process patterns. Russell et al. (2005) study resource usage patterns in workflows describing the distribution of work. Gaaloul, Baina, and Godart (2005) develop a workflow mining technique to discover workflow patterns from a workflow log. In another instance, e-business patterns have been used to capture knowledge of e-business architectures (Adams et al. 2001). To our knowledge, ours is the first paper proposing the concept of business process transformation patterns as a way to encapsulate transformation options.

In Section 2 of this paper, we describe the overall logic flow in the Business Process Transformation Wizard. In Section 3, we introduce the concept of Business Process Transformation Patterns and identify different patterns. In Section 4, we illustrate the BPT Wizard with an example based on an Engineering Change Management process. We conclude in Section 5, with some suggestions for future research.

2 SETTING THE CONTEXT – BUSINESS PROCESS TRANSFORMATION

Business users are interested in business process modeling with the broad objective of business process transformation, but most business users find simulation and optimization to be complex. The Business Process Transformation Wizard (BPTW) is meant to be a bridge that enables business users to leverage quantitative analysis techniques for business process transformation. The BPTW enables the transformation of business process models by identifying business process transformation opportunities and analyzing their performance under different scenarios. The net result is the construction of an improved business process model, as specified by selected Key Performance Indicators (KPIs). In order to analyze the business process performance under different scenarios, the BPTW may invoke different analysis techniques such as simulation, optimization, queuing analytics, systems dynamics etc. The Wizard also interprets the scenario analysis results both to communicate them in a suitable form to business analysts and also to suggest potential focus areas for transformation. Thus, it also alleviates the need to be an expert in the analysis techniques, which is a barrier in their current use.

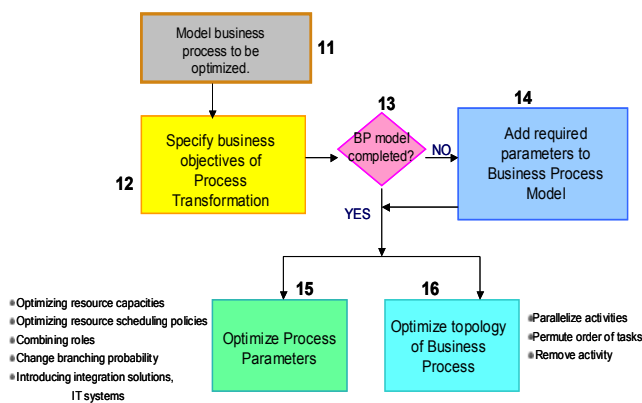The BPTW is described as a sequence of steps that the

Figure 1: BPT Wizard Flow Diagram

Wizard takes the business analyst through. Figure 1 illustrates by way of a flow diagram the overall process of the Business Process Transformation Wizard (BPTW). As will become clear from the following description, the process is simplified for the business analyst by the Wizard. The process begins in function block 11 where the business process to be optimized is selected. Next, in function block 12 the business objectives of the process transformation are specified. At decision block 13, a determination is made as to whether the business process model is completed. If not, the business process model is further developed and the required parameters are added to the business process model

in function block 14. When the business process model is completed, the process splits into two branches. The first of these in function block 15 is to optimize process parameters. The second branch in function block 16 optimizes the topology of the business process.

3 BUSINESS PROCESS TRANSFORMATION PATTERNS

We use the concept of Business Process Transformation patterns to encapsulate the different transformation possibilities that can be potentially explored by a business analyst. A number of business process transformation patterns can be leveraged to assess potential process transformation options, in order to optimize process parameters. These transformation patterns include:

- *Optimize resource capacities*
  This pattern results in potential reduction of operating costs, by reducing resource capacities in different roles.
- *Optimize resource scheduling policies*
  This pattern results in potential improvement in service and reduction in cost, by refining the scheduling policies governing the allocation of resources to different activities.
- *Combine roles*
  This pattern results in potential reduction in operational costs, by creating new roles in the process, by aggregating multiple existing roles.
- *Change branching probability*
  This pattern results in potential operational improvements, by modifying the probability that a specific branch is chosen by a token. The change in probability may in turn be realized by different means, such as employing improved technologies for managing flows, etc.
- *Introduce business integration solutions, IT (Information Technology) systems*
  This pattern results in potential improvement in operating costs, by automating the process using business integration and other information technology solutions.

The topology optimization step also leverages a number of Business Process Transformation patterns to assess potential process transformation options. These patterns include:

- *Parallelize activities*
  This pattern results in potential operational improvements, realized by performing process activities in parallel.

- *Permute the order of tasks*
  This pattern results in potential operational improvements, realized by modifying the order in which different tasks are performed.
- *Remove activities*
  This pattern results in potential reduction in operational costs, realized by removal of specific activities in the process. This pattern often accompanies other patterns in a business transformation – for example, introduction of IT solutions may make some activities redundant.

Note that steps involving specific transformation patterns are optional, i.e. the analyst can choose an appropriate subset of transformation patterns in a business process. The Wizard may request the business analyst for additional inputs such as resource utilization criteria and throughput criteria for analyzing specific process transformation patterns. For instance, the pattern "Optimizing Resource Capabilities" may involve optimization of resource capacities, subject to resource utilization targets, business throughput targets and lead time targets.

4   ILLUSTRATIVE EXAMPLE

We will illustrate the Business Process Transformation Wizard using an example business process based on Engineering Change Management, a schematic of which is shown in Figure 2. In this process, potential engineering change opportunities are identified in activity "Identify Engineering Change Opportunity". Identified opportunities are then analyzed by different people in the organization in activity "Analyze Engineering Change Opportunity" and feedback obtained. Then, feedback is analyzed to make a decision on whether to accept the opportunity for implementation in the decision node "Accept Opportunity". If the opportunity is accepted, then a solution is developed to address the opportunity in activity "Develop Solution"; or else, the identified opportunity is archived. We will use this process as an example to illustrate how the Business Process Transformation Wizard as exemplified in this embodiment, can serve to identify and assess business process transformation opportunities. Note that this is only a high level depiction of the Engineering Change process and there are several detailed sub-processes that are not shown in this figure.
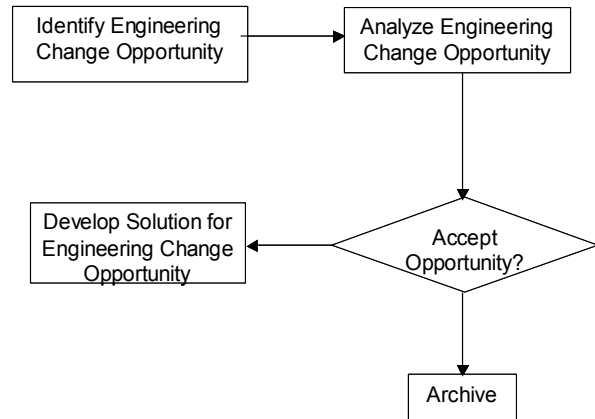

Figure 2: Illustrative Example for BPT Wizard – Engineering Change Management

The business analyst is asked to specify Key Performance Indicators (KPIs) that measure business process performance. This can be chosen from a list of KPIs , such as cost, revenue, resource utilization, etc. Next, the business analyst is prompted to specify business process transformation objectives. For example, a potential objective is the reduction of operational costs by 10%. Now the Wizard prompts the business analyst to specify parameters for the business process. This is to ensure that sufficient data is specified that enables the analysis of business process performance. This could consist of activity resource requirements, resource capacities, etc. The Wizard effectively guides the user to select appropriate random distributions for different process aspects – such as arrival rate to the process, duration of a task etc. In some cases, the Wizard can suggest default distributions and can allow users to specify alternate distributions.

The Wizard then proceeds to validate and confirm feasibility of selected parameters. Here the business analyst is prompted for model validation criteria. Once the model validation criteria have been entered by the business analyst, the Business Process Transformation Wizard executes the process analysis. This may involve execution of process analysis algorithms, such as simulation, queuing analytics, systems dynamics, etc. In the course of executing the process analysis, the Business Process Transformation Wizard checks whether the results validate the model according to the specified criteria. If satisfactory, the Business Process Transformation Wizard confirms that the model validation criteria have been satisfied and displays the results. If unsatisfactory, the Business Process Transformation Wizard will request the analyst to either change the process and/or process parameters and perform multiple iterations, until the model validation criteria have been met.

The Wizard now prompts the business analyst to specify business process transformation patterns for optimizing

process parameters, and optimizing topology of the business process. This may optionally involve specification of additional parameters specific to particular transformation patterns. Let us consider the pattern "Optimize Resource Capacities". The Wizard prompts the business analyst to enter target utilization figures as criteria for optimizing resource capacities. Once the utilization figures have been entered, the Business Process Transformation Wizard executes the process analysis. When the process analysis is completed by the Business Process Transformation Wizard, the results of the resource capacity optimization are displayed in the screen shown in Figure 3. Note that the capacities in different roles have changed, leading to a cost reduction from $1.2 million to $950K.
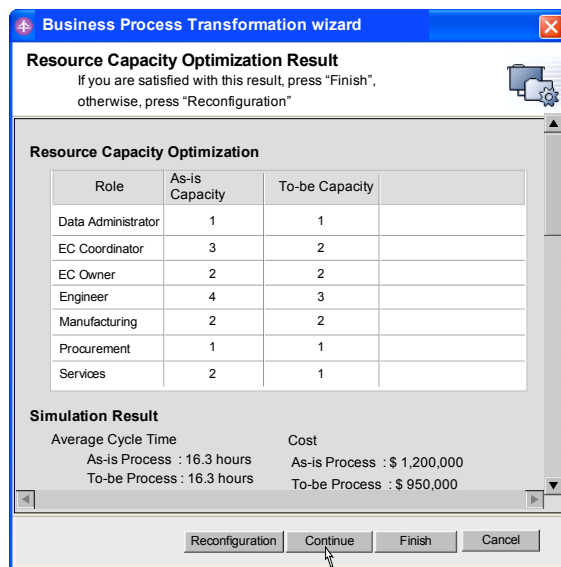
Figure 3: Results of Resource Optimization Pattern

With the "Combining Roles" pattern, the business analyst is requested to specify roles that can be potentially combined. This can be alternatively suggested by the Wizard, which executes the process analysis (multiple times as appropriate) and identifies the combination of roles that optimize the business process performance. The screen shown in Figure 4 is displayed and prompts the business analyst to specify various roles that can be potentially combined. After entering those roles that can be combined, the Business Process Transformation Wizard then executes the process analysis. When the process analysis is completed by the Business Process Transformation Wizard, the results of the optimized process are displayed in the screen shown in Figure 5. Note from the simulation results that the process cost has been reduced to $875K, as a result of combining roles.
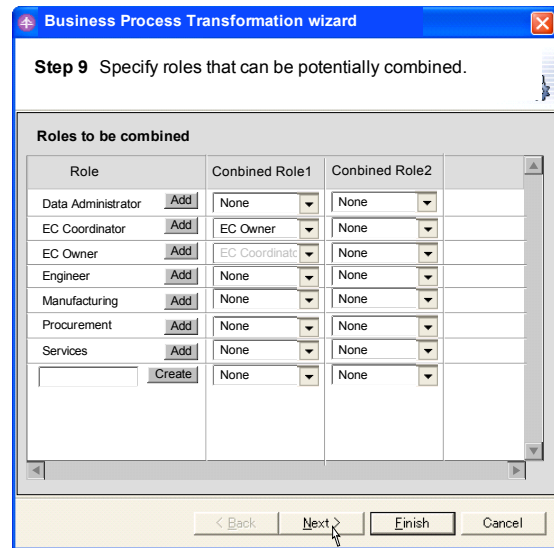
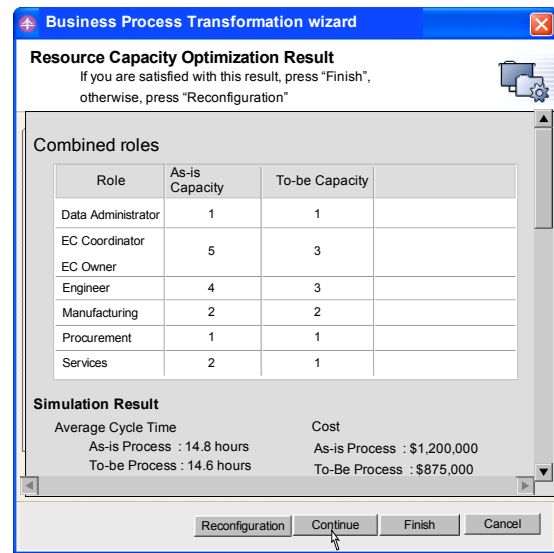Figure 4: Combining Roles Pattern – Specifying Roles that Can Be Potentially Combined

Figure 5: Results of Combining Roles Pattern

With the "Introducing IT Systems" pattern, the Wizard requests the business analyst to specify impact level on each task by introduction of IT systems for process automation/integration. Impact levels can be "fully automated", "partially automated", "outsourced", "no impact", etc. Elapsed duration for execution of each task is reduced based on predefined rules and the specified impact levels. For example, "fully automated" may reduce the elapsed duration by 50%, "partially automated" by 20%, "no impact" by 0% etc. Optional user interaction is allowed to customize reduction of elapsed duration of each task. When the process analysis is completed by the Business

Process Transformation Wizard, the results of process transformation using IT solution can be assessed, as depicted in Figure 6.
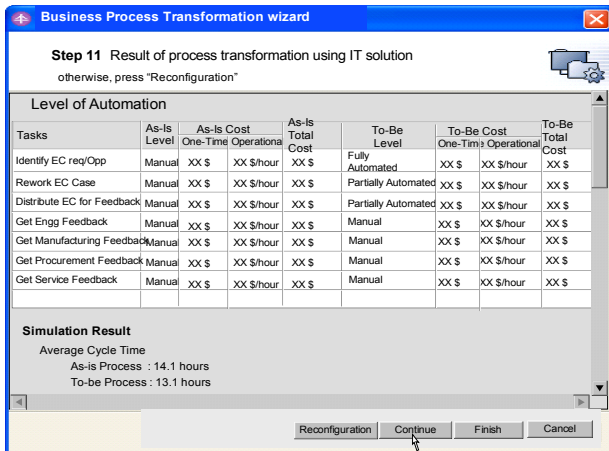

Figure 6: Introducing IT Systems Pattern

Figure 7: Recommended Business Transformation

With the "Parallelize BP subdiagram" pattern, the Business Process Transformation Wizard requests the business analyst to specify process activities that can be potentially executed in parallel. This can be alternatively suggested by the Wizard which executes the process analysis (multiple times as appropriate) and identifies the combination of activities that can be executed in parallel, which result in overall business process performance improvement. After entering those tasks, the BPT Wizard executes the process analysis, and the impact of parallelising some tasks on overall process KPIs are displayed.

After the overall analysis of different business transformation patterns, the BPT Wizard then recommends a subset of transformation for further consideration and implementation, as shown in Fig. 7. In this illustrative example, the BPT Wizard recommends the patterns "Optimizing Resource Capacities", "Combining Roles" and "Introducing IT System" for implementation.

5 CONCLUDING REMARKS

In this paper, we have proposed the notion of Business Process Transformation Wizard as a means to make quantitative capabilities such as simulation more usable for business analysts. We further introduced the concept of Business Process Transformation Patterns as a way to realize potential transformation options. Further work is needed in automatically identifying appropriate transformation patterns based on process characteristics Moreover, process transformation cases need to be analyzed to examine the possible existence of other transformation patterns.
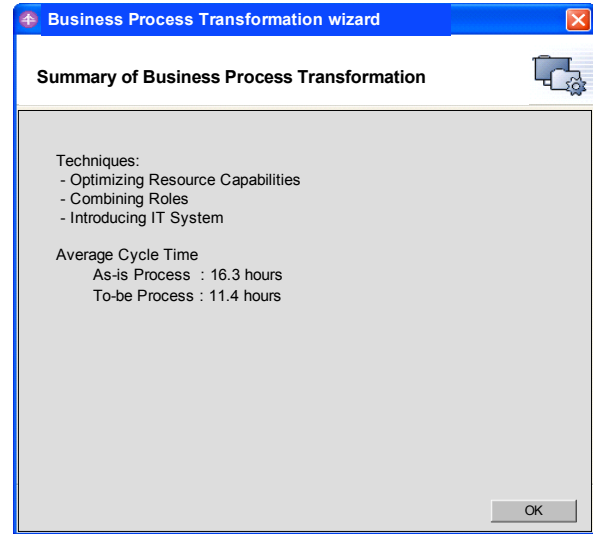
REFERENCES

Adams, J., S. Koushik, G. Vasudeva, and G. Galombos. 2001. Patterns for e-business: A Strategy for Reuse. IBM Press.

Gaaloul, W., K. Baina, and C. Godart. 2005. Towards Mining Structural Workflow Patterns. *Lecture Notes in Computer Science*, v3588, Database and Expert Systems Applications, 16th International Conference, DEXA, pg 24-33.

Laguna, M., and J. Marklund. 2004. *Business Process Modeling, Simulation and Design*. Prentice Hall Publishers.

Russell, N., W. van der Aalst, A.H.M. Hofstede, and D. Edmond. 2005. Workflow Resource Patterns: Identification, Representation and Tool Support. *Lecture Notes in Computer Science*, v3520, Advanced Information Systems Engineering, 17th International Conference CAISE, pg 216-232.

Thom, L.H., and C. Iochpe. 2004. Integrating a Pattern Catalogue in a Business Process Model. In *Proceedings of the Sixth International Conference on Enterprise Information Systems,* ICEIS, pg 651-654.

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