Foreword

This monograph is a beautiful mixture of rigorous scientific research and very practical experiences. The monograph provides several new insights in the field of business process modeling and analysis. The term "workflow process" is used instead of "business process" to express the focus on the handling of a flow of cases in an organization. In the last decade the process view has become the dominant way to structure organizations. Although many books promote this view, they seldom provide a scientifically sound approach to modeling and analyzing business processes.

There are two important aspects of a business process: its correctness and its efficiency. The first aspect concerns the correct handling of cases, i.e., without logical errors, and the second concerns the throughput time for cases and the effort required to execute them. The monograph provides new results for analyzing these two aspects, but there are also new results for the redesign of processes. Two approaches are offered: heuristics to redesign an existing process and a derivation method to develop a process given a specification of the desired output of the process.

The research for this monograph was conducted by Hajo Reijers during the last five years while he was working halftime for Deloitte & Touche as a management consultant and halftime as a Ph.D. student at the Eindhoven University of Technology. It was a great pleasure for me to be both his thesis advisor at the university and his supervisor in the consulting firm. The unique combination of scientific work at the university and real practice as a consultant turned out to be very fruitful. Many ideas for this research popped up during consultancy work and several scientific results were successfully applied in industry.

The monograph contains many interesting results that are worth applying in practice, while it is also a source of new and intriguing questions for further research.

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Preface

The motivation behind the conception of this monograph was to advance scientific knowledge about the design and control of workflow processes. A workflow process (or workflow for short) is a specific type of business process, a way of organizing work and resources. Workflows are commonly found within large administrative organizations such as banks, insurance companies, and governmental agencies. Carrying out the tasks of a workflow in a particular order is required to handle one type of case. Examples of cases are mortgage applications, customer complaints, and claims for unemployment benefits. A workflow used in handling mortgage applications may contain tasks for recording the application, specifying a mortgage proposal, and approving the final policy. The monograph concentrates on four workflow-related issues within the area of Business Process Management; the field of designing and controlling business processes.

The first issue is how workflows can be adequately modeled. Workflow modeling is an indispensable activity to support any reasoning about workflows. Different purposes of workflow modeling can be distinguished, such as system enactment by Workflow Management Systems, knowledge management, costing, and budgeting. The focus of workflow modeling in this monograph is (a) to support simulation and analysis of workflows and (b) to specify a new workflow design. The main formalism used for the modeling of workflows is the Petri net. Many existing notions to define several relevant properties have been adopted, such as the *workflow net* and the *soundness* notion.

The second issue addressed in this monograph is the design or redesign of a workflow. Redesigning business processes has received wide attention in the past decade. Until this day, it has been seen as one of the major instruments available to companies for improving their performances. The monograph presents the Product-Based Workflow Design (PBWD) method, which derives a workflow design from the characteristics of the product it supports. This concept is well known in manufacturing where an assembly line may be determined on the basis of a Bill-of-Material, but is rather unorthodox in administrative settings. The method allows us to use context-specific design targets, such as cost reduction or responsiveness improvement, to determine the final design. Aside from its methodological and technical foundation, practical experiences are presented within a large Dutch bank and a social security agency with PBWD. In addition, the monograph contains about 30 redesign heuristics. These heuristics are derived from both existing literature and practical experience. They can be used to redesign business processes in a more conventional, incremental way. A case description is added to illustrate the application of these heuristics.

The third issue is the performance evaluation of workflow processes. A new stochastic version of the Petri net is presented that addresses both the structural characteristics of workflows and its typical timing behavior. Two techniques are described that can be used to determine the stochastic behavior of a workflow design as measured in its throughput time. The throughput time of a single case is defined as the amount of time that passes from the start of its processing to its completion. Both techniques may help the designer of a workflow to determine whether the design targets will be achieved by the new design. The first technique uses basic building blocks and a well-known synthesis technique to construct a workflow model that can subsequently be analyzed exactly. The Fast-Fourier Transform is used to improve the efficiency of the analysis. The second technique can be applied to the subclass of sound, free-choice, and acyclic workflow nets to determine lower and upper bounds for the throughput time distribution of the respective net. An important restriction of both techniques is that they abstract from resource constraints.

The fourth and last issue addressed in this monograph is how to sensibly allocate resources in an operational workflow. Once again, the performance indicator focused on is the throughput time. A familiar approach used in industry is to add extra resources at bottle-necks within the business process, i.e., the classes of resources that are pressed the hardest, to reduce the throughput time. This approach is critically assessed and its limitations are presented. An alternative method for *marginal allocation* is presented. Its optimality is proven for a subclass of stochastic workflow nets with resource constraints. To derive an inductive feeling of its effectiveness outside this class, a workbench of workflow nets has been developed. Simulation techniques have been used to test the method of marginal allocation on this workbench, which has led to cautious but positive conclusions.

The common feature of the treatment of the four issues is an attempt to provide scientific support for Business Process Management and the management of workflows in particular.

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