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Product-based workflow support ☆

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ABSTRACT

Despite the industrial need for the improvement of information-intensive business processes, few scientifically grounded approaches exist to support such initiatives. In this paper, we propose a new approach that builds on concepts that are part of a product-oriented view on process optimization. Essentially, this approach allows end users to flexibly decide on the best possible way to create an informational product within the limits that are imposed by regulations and logical dependencies. We argue that this provides various benefits in comparison to earlier work. To support end users in making sensible decisions, we describe two alternative approaches to provide them with recommendations to this end. We formalize these alternatives and discuss their relative strengths and weaknesses. The feasibility of the overall approach, which we refer to as Product-Based Workflow Support, is demonstrated by a workflow system that is realized using ProM and DECLARE.

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1. Introduction

Contemporary management concepts such as "operational excellence," "lean management," and "business process redesign" all stress the importance of smoothly running business processes. It seems a natural angle from which to consider *processes* – complete chains of operations that are needed to produce certain products or services – to make organizations perform better. Unsurprisingly, market analyses consistently identify the improvement of business processes as the top business priority for CIO's [22–24].

Given the importance of business processes and their tight relation to organizational performance, it may come as a surprise that few scientific approaches are available that address the issue of how to actually *design* a process or, since in many contexts the processes are already in place, how to *redesign* one. The best-known references are situated in the domain of the popular management literature, e.g., [11,14,17]. Understandably, it is often said that process design is "more art than science" [44,45].

One of the notable exceptions is Product-Based Workflow Design (PBWD) [37]. PBWD has been developed in close cooperation between academic and industrial parties to arrive at a method for process redesign that is repeatable, objective, and effective. Its focus is on the design of processes that deliver informational products, the so-called *workflow processes*. Since its conception, PBWD has been adopted by consultancy and service companies to improve the performance of various business processes in the services domain [35,36].

Highly characteristic for PBWD is that it aims first and foremost at developing a deep understanding of the characteristics of the *informational product* that is to be delivered, e.g., a particular type of decision, proposal, permit, etc. which is laid down in a *product data model*. This is subsequently used by the designer to determine the best process structure to create and deliver that product. Given that there are generally alternative ways to produce an informational product, PBWD discloses all the opportunities to produce a product.

At this stage, considerable experience has been gained with the application of PBWD in practice. Aside from the

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tangible business benefits that PBWD has delivered, it has become apparent that the "product" notion is an extremely viable concept to reason about workflow processes. The shift of attention to what is the desired *outcome* of a workflow process without directly discussing *how* this is achieved leads to an interaction with stakeholders that quickly converges. This sharply contrasts with the problems that are often associated with process improvement projects, such as the confusion about what actions in the current process are really necessary and which ones are merely motivated by tradition [14,41]. Interestingly, IBM's recent artifact-centric approach takes a similar indirect route by first considering the objects that are manipulated in a process before the focus moves to the actual process design [6].

At the same time, it must be acknowledged that the translation of the product data model to a favorable workflow is a critical step. In the first applications of PBWD this derivation was done manually [36, pp. 256–273]. Since this is time-consuming and error-prone, we have been developing IT tools to support the administration of a product data model, as well as algorithms that automatically generate workflow designs on the basis of a product data model [46]. Still, business users find it difficult to consider and compare all the options that are available for the final workflow design. The reasons for this are that, in general, there are many of these that may differ in subtle ways: While some options may work well for some cases, they may not do so for others.

This paper presents an entirely new outlook on the use of the product data model. Instead of aiming at the derivation of a workflow design that is generally the best possible way to generate an informational product, the product data model *itself* is proposed as the vehicle to steer a workflow's execution. In other words, the need to translate a product data model into a workflow design disappears. Instead, a business user determines on a case-by-case basis the best possible way to create an informational product in accordance with the relevant product data model. This approach addresses the difficulty for business users to compare many alternative workflow designs, while it still relies on the product data model with its attractive properties. In addition, this approach allows for a highly dynamic and case-specific execution of workflows, as will be illustrated in the remainder of this paper.

The proposed approach builds on two pillars. First, we exploit the wide industrial proliferation of "process-aware" or "process-oriented" information systems [13,26]. We will assume the existence of such type of system to support the proposed approach and, along the way, show the feasibility of this idea in the form of a prototype workflow system. Second, the offered solution rests on the idea that it is easier for a business user to determine the best possible action in the context of processing a *single* case versus a *general* case. To guide the business user in this respect, we present two alternative approaches to provide her with recommendations: one that is optimal in relation to a dominant performance criterion but rather computing-intensive, and another that is computationally lightweight but based on heuristics.

Our contribution can be summarized as follows. We present a rigorous approach for business process improvement, which addresses the need for guidance in this respect from practice. The innovative aspect is that we do not aim at the design of an underlying generic process; instead, we provide a business user with direct support for delivering an informational product in a performative way. To do so, we build on the successful notions from PBWD, in particular the product data model, in order to arrive at a method that we coin "Product-Based Workflow Support" (PBWS). In this approach, the product data model specifies the elements to assemble a particular product, while a process-aware information system suggests how a business user should use these to deliver the product in the best possible way.

The structure of this paper is as follows. Section 2 contains background information, a running example and the motivation for PBWS. Next, Sections 3 and 4 present the two alternative realizations of the envisioned support. A comparison of these two approaches is given in Section 5, followed by a description of a workflow system (based on ProM and DECLARE) to support the overall approach provided in Section 6. The paper ends with related work and conclusions.

2. Background and motivation

This section provides information that is essential as background for the remainder of the paper. In particular, the product data model is explained and illustrated with an example. We also provide motivation for the idea of PBWS.

2.1. Workflow products

The product of a workflow process is an *informational* product, e.g., a decision on an insurance claim, the allocation of a subsidy, or the approval of a loan. Based on the input data provided by the client or retrieved from other systems, the process constructs the end product step-by-step. In each step new information is produced based on the specific data present for the case.

In this paper, we use a financial workflow process as a running example. The workflow process deals with the calculation of the maximum amount of mortgage a bank is willing to loan to a client. The bank has three alternative ways to decide on the maximum mortgage. First of all, if the client has a negative registration in the central register for credits (e.g., the client has a history of non-payment), the bank may directly deny this person a mortgage (leading to a maximum amount of zero). The central credit register keeps track of all loans a person has and helps providers of loans in their assessment of the creditworthiness of such a person.

Second, if the client has previously requested a mortgage offer and the term of the validity of this offer is not yet expired, this may determine the amount of the mortgage. Typically, the percentage of interest changes over time, and a mortgage offer is valid for some months. In case the interest has increased since the previous offer,

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