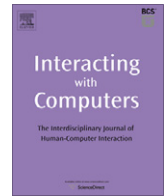




Contents lists available at ScienceDirect

# Interacting with Computers

journal homepage: [www.elsevier.com/locate/intcom](http://www.elsevier.com/locate/intcom)

## Supporting business process experts in tailoring business processes

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### ARTICLE INFO

#### Article history:

Received 27 May 2010

Received in revised form 1 March 2011

Accepted 3 March 2011

Available online 9 March 2011

#### Keywords:

End-user design environments

End-User Development

Empirical analysis

Composition tools

Business process modeling

Enterprise Resource Planning

### ABSTRACT

Supporting end users to adapt business processes is rather uncommon in the context of large Enterprise Resource Planning systems. We present our new business process modeling environment, called SiSO, that enables business process experts to model and adapt business processes. SiSO enhances the descriptions of services that are provided by Service-Oriented Architectures. These enhanced descriptions focus on organizational-specific information, which makes it easier for business process experts to understand the capabilities of services in their organizational context. The information includes descriptions of services' functions, ratings, and keywords. SiSO's graphical user interface employs the box-and-wire UI design technique to enable business process experts to model business processes in the context of Enterprise Resource Planning systems. SiSO was qualitatively evaluated with six employees of three different companies and found useful in two application fields: (a) the visualization and automation of business processes and (b) the creation of calculations using data from different systems and sources. We think that enabling business process experts to create individual business processes is an important challenge for the design of future Enterprise Resource Planning systems.

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### 1. Introduction

#### 1.1. The need for tailoring business processes

Today's working environments call for flexible work practices and dynamic Enterprise Resource Planning (ERP<sup>4</sup>) systems in support of these practices because these systems are adaptable to environmental changes (Germonprez et al., 2007; Kawalek and Leonard, 1996; von Hippel, 2005). Developing systems that are flexible and "easy-to-adapt" by end users has been the focus of End-User Development (EUD), end-user programming, end-user computing, and (end-user) tailoring. EUD aims at developing methods, techniques, and tools that allow end users to create, modify, or extend software artifacts (Lieberman et al., 2006). Different types of end users have been identified in this research stream (Åsand and Mørch, 2006; Fischer et al., 2004; MacLean et al., 1990; Nardi and Miller, 1991; Rockart and Flannery, 1983). Among them, "super users" are seen as boundary spanners and are considered to be the best candidates

for tailoring software (Åsand and Mørch, 2006; Mørch and Mehandjiev, 2000). In this paper we prefer to use the term *business process experts* to refer to such domain experts, who usually have some expertise and experience in programming and system adaptation, such as creating Excel sheets or adapting complex systems' options to their preferences.

Tailoring plays a significant role in ERP systems (Gurram et al., 2008) and requires the involvement of business process experts because they have detailed knowledge of the adaptation problems that should be addressed (Pfeiffer et al., 2008). Current literature presents arguments in favor of enabling business process experts to adapt business processes—a business process is understood as a sequence of activities that can be defined by users and executed by a machine (Melão and Pidd, 2000). One advantage of enabling business process experts to adapt business processes is the reduction of the time required to implement the changes (Agostini and Michelis, 2000).

Frequent adaptations in dynamic environments often lead to higher costs than the costs of the initial design, implementation, and introduction of the system. These costs can be cut if business process experts are enabled to do the adaptations themselves (Beringer, 2004). In addition, adaptation processes, lead by external experts, may lead to communication problems (Gallivan and Keil, 2003). We conclude that enabling business process experts to adapt systems shortens the adaptation process, cuts down costs, and increases the overall quality, while offering a high level of flexibility at the same time. Small and medium enterprises (SMEs) can benefit even more from enabling business process experts to

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<sup>4</sup> ERP systems are big software packages consisting of different modules/sub-systems that provide functionality for managing and controlling the core tasks of enterprises (e.g. human resources, production, sales, and finance).

adapt systems because they have less personnel and financial resources than larger enterprises.

### 1.2. Gaps in current research

Professional business processes modeling tools and Service-Oriented Architectures (SOAs<sup>5</sup>) lack features for enabling business process experts to modify or develop business processes within their work environment. In fact, the orchestration of business processes requires technology that allows for flexible composition of system components. This is probably the main reason for why SOAs, being the latest trend in software flexibilization and reuse, have become the new design paradigm for ERP systems (Liu et al., 2008). An important example is the shift of SAP R/3 to the service-oriented SAP NetWeaver architecture (Heilig and Karch, 2008). SOAs support the modeling of business processes and a dynamic linking of services to the processes without programming these links. Based on SOAs, business process modeling environments have been developed by several companies, including IBM and SAP. However, some problems remain that are critical for enabling business process experts to modify business processes:

- First, SOAs primarily focus on the automation of machine-to-machine interaction and neglect human dimensions (e.g., no support of non-technical meta-data, such as usage descriptions of the services and their functions, ratings, and keywords).
- Second, composition tools are not designed for business process experts, who have less programming skills than professional developers.

Empirical studies report that even professional developers struggle with the implementation of SOA-based business processes. For example, service interfaces are technically oriented and do not provide non-functional and usage-related information (Brahe, 2007). This makes it harder to understand APIs (Beaton et al., 2008) as well as to find services that offer the required functionality (Aguilera et al., 2007; Hoyer et al., 2008). Visual process modeling tools are offered as a solution by leading software vendors, such as SAP, IBM, Software AG, Oracle, and TIBCO,<sup>6</sup> but they demand both domain expertise and advanced skills in computer use (Mørch and Mehandjiev, 2000). Such tools are unusable for business process experts, who have domain expertise, but limited skills in computer programming (e.g., typically no knowledge of XML or programming languages beyond Excel).

### 1.3. The purpose of this paper

We present a business process design environment for business process experts, called SiSO (Simple Service Orchestration), which enables them to model and adapt business processes in the context of ERP systems. SiSO is an effective design environment for business process experts because it uses the advantages of SOA technologies and overcomes the aforementioned deficits of supporting the human dimension of SOAs by applying UI design techniques used in mashup tools.

Our work addresses the following research questions:

- (1) What are the requirements for a business process design environment for business process experts?
- (2) How can these requirements be implemented effectively?

- (3) How do business process experts perceive the usability and usefulness of this environment?

This article makes two major research contributions: First, it extends the focus of SOAs with respect to their human dimension by enhancing SOAs through non-technical meta-data, such as usage descriptions of the services and their functions, ratings, and keywords. Second, it provides a tool which employs the well-known box-and-wire UI design technique in a new way in order to enable business process experts (with little programming skills) to model business processes in the context of ERP systems.

### 1.4. Methodology

We employed different methods to answer our research questions (each method will be described in more detail in the relevant sections). The following paragraphs provide a brief overview of the methods used:

- (1) The identification of the requirements followed a pluralist research approach, combining qualitative and quantitative research methods to generate richer and more reliable results (Mingers, 2001; Myers, 2009). We conducted a literature analysis to identify general requirements and two empirical studies to identify domain-specific requirements. This included a case study which explored the application domain and an online survey to validate the results of the case study.
- (2) The subsequent design process of the prototype was based on a participatory design workshop (Muller, 1991, 1992) involving business process experts. Participants created mock-ups of the envisaged system, based on their knowledge of the application domain and the existing work practices.
- (3) We used two different methods in combination to conduct the user tests: participatory observations and the thinking-aloud method. Business process experts from different companies used SiSO to solve the given evaluation task and verbalized their thoughts. In addition, they were interviewed about the usefulness of the tool at the end of the session.

This article is organized as follows. We will briefly discuss the related work (Section 2). Afterwards, we will focus on the three research questions in the subsequent sections: presenting the requirements analysis (Section 3), describing the development of the business process design environment (Section 4), and reporting on the evaluation of the designed prototype (Section 5). Section 6 discusses the merits, limitations, and implications of this work. Section 7 offers some conclusions and future research directions.

## 2. Related work

We will discuss those mashup tools that are related to SiSO and have inspired its design. Marmite is such a mashup tool, which enables end users to combine existing Web content and services from multiple Websites into new applications that were not envisaged by the websites' designers (Wong and Hong, 2007). Marmite uses a dataflow architecture that is similar to Unix pipes. It supports the extraction of content from websites (e.g., names, addresses, and dates), which can be processed in different ways, such as filtering values or adding metadata. Its output can be directed to different sinks, such as databases, map services, and web pages. However, Marmite cannot use other data sources than websites and cannot be used in an ERP context.

Yahoo Pipes is another mashup tool, available on the web. Its UI design technique is similar to Marmite. It offers predefined

<sup>5</sup> A Service-Oriented Architecture is a set of components that have a public interface description (usually in XML) and can be invoked via Internet protocols, such as HTTP.

<sup>6</sup> It should be noted that there are more and better business process modeling tools nowadays than back in 2006–2008, when this work was done.

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