Management and Engineering of Process Aware Information Systems:
Introduction to the Special Issue

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Introduction

In this editorial letter, we provide the readers of Information Systems with a birds-eye introduction to Process-aware Information Systems (PAIS) – a sub-field of Information Systems that has drawn growing attention in the past two decades, both as an engineering and as a management discipline. Against this backdrop, we briefly discuss how the papers included in this special issue contribute to extending the body of knowledge in this field.

Process-aware Information Systems and Associated Research Challenges

Process-aware information systems are at the heart of an ongoing trend that has seen the attention of information systems engineers and managers shift from data and objects to the processes that the information system – and the organizational environment in which it operates – is intended to support, enable or enact [1]. This trend has resulted in a myriad of approaches to support the analysis, design, implementation, execution and maintenance of information systems, ranging from those supported by groupware [2] to those supported by workflow management systems [3] and more recently business process management systems [4]. We subsume such different information systems with a process focus under the umbrella of Process-Aware Information Systems (PAIS). A PAIS is a work system that supports the delivery of products and/or services to customers by processing information on the basis of explicit process models [5].

Process awareness has emerged as a guiding principle not only in the design and analysis of information systems, but also as a management discipline in its own right. Indeed, the improvement of business processes is a perennial top priority of chief information executives [6]. When seeking to re-design business processes to improve operational efficiency, increase

compliance or foster business innovation, managers increasingly turn to Business Process Management (BPM) [7] – a body of principles and methods that support the modelling, analysis, design and implementation of PAIS. The appeal of BPM lies in its promise to create sustainable high-performing processes that demonstrate strategic strengths such as the ability to respond better to rapid change or to standardise operational best practices across business units or locations.

PAIS are complex socio-technical systems in which managerial and organizational aspects are often entangled with system analysis, design and implementation aspects. An integrated understanding of these complementary aspects is essential to reap the potential benefits of PAIS. However, management and engineering aspects of PAIS have to date mostly been studied separately. On the one hand, the information systems engineering community has concentrated on PAIS analysis, design and implementation, using for example case handling systems [8], workflow technology [9], business process management systems [4] or service-oriented architectures [10]. On the other hand, the information systems management community has focused on the impact of information systems technology to support process-oriented organizations [11], the usage of process-aware technology [12], process modeling methods [13, 14] and process redesign practices [15], or the management of cultural and organizational change to enable process improvement [16]. Overall, these research streams have mostly been isolated from one another so far. In part, this is due to differences in research cultures. While research into PAIS engineering often adopts methods falling under the umbrella of Design Science – seeking to construct technology artefacts that respond to given problems – research into management and social aspects of PAIS generally relies on empirical research methods such as surveys, interviews and structured case studies – in the tradition of the behavioural sciences. As a result, two distinct

research silos have emerged and only a relatively small share of studies fully embrace the holistic and boundary-spanning nature of PAIS as socio-technical systems.

With this special issue, we aimed to provide a forum to bridge the viewpoints of the information systems engineering community and the information systems management community, as it pertains to PAIS. The special issue explicitly advocated multi-disciplinary approaches that expand and integrate isolated research efforts in engineering and management of PAIS, or that bridge design-oriented with behavioural IS research efforts. We were hoping to foster increased communication between the research camps, to instil multi-disciplinary perspective in research on process-aware information systems, and – last but not least – also to provide a sample of state-of-the-art quality research in this relevant field of research.

Contents of the Special Issue

In response to the call for papers for this special issue, overall fourteen submissions were solicited. After three rounds of rigorous peer review and editorial review, we selected three papers for inclusion in the special issue. Each paper was reviewed by two expert reviewers plus the three guest editors. The acceptance rate speaks both for the high standards of rigor and relevance that we applied to the research submitted for inclusion, and the high standards of research achieved by the three articles accepted. We believe that the articles selected serve as an excellent demonstration how to combine design-oriented and empirical studies in one successful research design.

The first paper, "Perceived Consistency between Process Models", by Matthias Weidlich and Jan Mendling, takes a look at consistency notions as they apply to the modelling of process-aware information systems. Process model consistency is an important criterion to prevent

contradictions between multiple variants of the same model, which is of importance especially in phases of process-aware information systems analysis and design where multiple stakeholder parties and modelling purposes are involved. To investigate process model consistency, the authors discuss different formal notions of behavioural consistency, introduce the new formal concept of consistency based on behavioural profiles, and present an experimental evaluation to examine the correspondence between formal and perceived consistency of process models based on a study with 69 process analysts. Thereby, the paper clearly demonstrates how research on engineering aspects of PAIS (the development of new formal consistency notions) can be complemented meaningfully with a rigorous evaluation from a managerial and behavioral perspective (how process analysts perceive pairs of process models).

In the second paper, "Business Process Analysis in Healthcare Environments: a Methodology based on Process Mining", Álvaro Rebuge and Diogo R. Ferreira present an extension to process mining technology to support specifically the complex and ad-hoc nature of clinical workflows. They define a methodology for the application of process mining techniques that leads to the identification of regular behaviour, process variants, and exceptional medical cases, and develop a tool prototype that implements the methodology. They then proceed to apply their methodology and the associated tool in a case study conducted at a hospital emergency service. Through their work, the contribute to PAIS by designing an extended process mining methodology and tool, and by studying empirically how this PAIS technology can be applied in practice to provide insights into the flow of healthcare processes, their performance, and their adherence to institutional guidelines. The learning provided thereby assist in the management of PAIS technology.

Finally, the third paper accepted to our special issue, "Trace Alignment in Process Mining: Opportunities for Process Diagnostics" by Jagadeesh Chandra Bose Rantham Prabhakara and Wil

M. P van der Aalst, complements the second paper, by delving deeper into the problem of identifying "regular behaviour" in process execution logs. The paper applies a technique that is typically used for DNA analysis in the field of bioinformatics, namely *sequence alignment*. The basic idea put forward by the paper is that process execution traces can be seen as DNA sequences, with "event types" (e.g. task occurrences) taking the place of DNA-bases. Sequence alignment (called "trace alignment" in this paper) consists of adding "gaps" inside a sequence, so that when put below (or next to) one or multiple other sequences, the common parts of the sequences are clearly identifiable. One a collection of execution traces have been aligned, analysts can more easily identify "regular behaviours", which correspond to frequently repeated segments in the aligned traces. The usefulness of the proposed technique is validated on the basis of two sample logs from different application domains, which again corresponds to the careful and critical evaluation of managerial aspects surrounding a piece of PAIS technology.

Conclusions

To sum up, we believe this collection of papers not only makes an interesting read but is also representative of the current global research efforts in the field of Process-Aware Information Systems. The papers show that there is a lot to be gained by approaching management and engineering aspects of PAIS from a unified viewpoint.

We hope these papers will serve as inspiration for other researchers to contribute to building an innovative and empirically-grounded body of knowledge in the field of PAIS that delivers insights to organizations that strive for business innovation, operational excellence and agility, and we hope that these papers also send a positive signal to the academic community about the value of holistic and multi-method research on PAIS. We trust you will enjoy reading this special issue.

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