Knowledge Communities I: Knowledge Management

Process Learning Environments

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Structured Abstract

Purpose – Due to faster innovation cycles and competitive markets, current methods for implementing and adapting business processes can not keep pace with changing requirements and cause BPM solutions to falls short of business needs. The purpose of this paper is to propose a new approach for implementing an agile BPM methodology by substituting the plan-build-run approach with an incremental prototype-based model, removing intermediaries from the time critical path of business process evolution, and empowering end users to change business processes at runtime by manipulating process artefacts.

Design/methodology/approach – Based on interviews with customers and stakeholders and our experience in implementing complex BPM solutions in SMEs, we propose key concepts for an agile BPM approach and derive basic requirements for implementing a BPM system that allows users to redefine business processes during their execution. This analysis is supplemented by a brief overview of current research trends in modelling and implementing agile BPM.

Originality/value – All existing solutions examined by our team imply a separate modelling step by users or process managers. The designed key concepts enable users to implicitly model processes without interrupting day to day operations. Our approach enables organisations to introduce business process management in areas where agility is very important (e.g. product development) or to increase operational agility in areas with established BPM. Practical implications – An agile BPM solution can give organisations the flexibility they need to react quickly to changing markets and customer needs. We want to help them to introduce standardization and efficiency without losing agility. In areas where classical BPM is in place, our approach can increase the adaptation rate of process changes. In the areas of knowledge workers with a high level of agility, our approach can increase efficiency by supporting knowledge sharing.

Keywords – process learning; agile business process; process knowledge; business process management

Paper type – Practical Paper

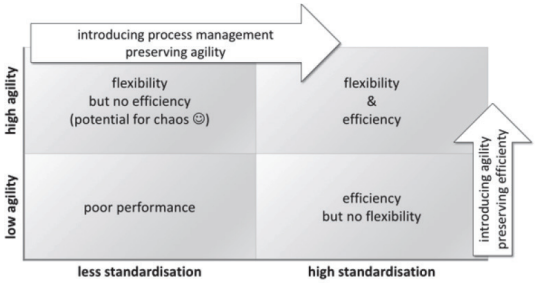

Figure 1: Introducing agile BPM

1 Introduction: The Debt of Accelerated Change

As software professionals in companies that develop customer specific process and document management solutions we have watched many of our customers struggling - and sometimes almost failing - to cope with the organisational demands of business processes changing faster than their supporting infrastructure can be updated. The reasons for these accelerated changes in business processes of organisations and enterprises are manifold: Faster innovation cycles, customisation and individualisation of products, dynamic changes in competitive markets, more flexible supply and value chains, changes in legislation, and structural changes in business units are only some of them. Failure to support factual changes in daily operations with the appropriate adaptations of the accompanying business processes leads to missed business opportunities and higher operational overhead.

On the other hand, changing established procedures and evolving business process management software infrastructure imposes a heavy burden on the organisation as a whole and on individual employees who "just want to get work done". Even if your staff really embraces change, few things cause less enthusiasm than introducing new BPM software. More often than not, the term "BPM software migration" is used as a pejorative for unfulfilled expectations, extended periods of extra work, decreased productivity, and widespread frustration over features delivered to late, not fit for the desired task or cumbersome to use.

An essential fraction of the risks for changing or introducing BPM software infrastructure originates from requirement analysis and business process modelling. Some customers face stern difficulties in formalizing and externalizing knowledge about their business processes, resulting in over-simplified uses cases with insufficient

coverage of non-trivial exceptions to the ‘easy path’. On top of this, different business units might have evolved subtle different notions about the handling of processes and naming of artefacts, which do not matter on the operational level but are tremendously difficult to implement in working software. The other end of the spectrum are customers who spend large sums on professional process consultants that come up with extensive and intricate process landscapes, describing even rare and simple processes in great detail – sometimes on a scale and level that makes this valuable knowledge too difficult or unwieldy to use, not only for software developers but also for users who are expected to think and operate within this framework.

In addition to this, most organisations include units, where the value of introducing BPM is widely recognized, but implementing BPM is difficult due to the very nature of their processes. This is especially true for e.g. research and development departments where knowledge intensive, emergent processes prevail. The processes of knowledge workers are semi-structured at most. Usually they can not be defined ex-ante and have to be designed at runtime.

Either way, understanding (and sometimes shaping) the process landscape of a customer to the point where it can be casted into useful and useable BPM software is time consuming and error prone. As processes keep on changing during requirement analysis, some of the results inevitably will be outdated on delivery. Agile software development methods have helped to mitigate these risks but are not applicable to all customers and do not solve the fundamental problem of business process models and BPM software failing to deliver on expectations due to a fast changing and complex reality that can not be modelled in a way that is both exhaustive and useable.

2 Key Concept: Agile BPM and Disintermediation for a faster BPM Cycle

Existing methods for BPM and for developing BPM software often incorporate the Plan-Build-Run-approach or apply the popular PDCA (Plan-Do-Check-Act) cycle. Both are recognised and well established methods for implementing a continuous improvement process. However, their application to BPM software infrastructure does not necessarily lead to the intended results. Especially in fast changing organisations, the planning stage consumes too much time and feedback from the check or run phase is integrated too late.

Employees who are required to use BPM software based on non-optimal process models develop strategies and shortcuts to mitigate the insufficient fit between the model and existing reality. When using conventional BPM software, this might actually amplify problems in the long run: increasing portions of the actual business process become decoupled from the model or are performed in ways that violate basic assumptions of the model. As control and coverage of processes will no longer

be provided by the existing BPM software and employees might try to obfuscate the derivation from company regulations, assessing and re-modelling theses processes for the next iteration cycle will become even more difficult.

By introducing agile concepts, methods, and tools to BPM, as described in section 5, empowering employees to adapt existing processes becomes part of the solution instead of causing additional problems. Our approach removes the intermediaries (e.g. process consultants, supervisors, and software developers) from the time critical path of business process transformations. Their role will change from gatekeepers to "gardeners", who will support employees by evaluating, structuring, regulating and streamlining the manifold process variations that will arise.

3 Requirements: Freedom of Choice vs. Normative Frameworks

With the power to change operational procedures of an organisation comes the responsibility to ensure, that these changes are beneficial to the organisation as a whole. A new or adapted process must operate within the boundaries given by strategic goals and legal requirements - and it must sustain interoperability with other processes or coworkers. One major challenge is to avoid, what can be called "the entropic death" of the BPM system, caused by e.g. a large number of fairly similar processes that have accumulated over time due to minute changes, that resulted in yet-another-workflow for a certain task and a multiplicity of ambiguous denominations for artefacts.

Among other things, guidelines have to be in place for deciding, whether an entirely new process should be established or if a given process should be adapted, with these adaptation being mandatory in a global scope. Also, a self-sustaining process must be established that consolidates the naming of concepts and artefacts or at least creates awareness for existing ambiguities and duplicate naming schemes . Such normative processes have to be backed by a common set of rules, comparable to the values and principle of the 'Manifesto for Agile Software Development'[1] and they have to be supported, and sometimes to be enforced, by appropriate software tools.

Therefore, our approach will focus on the following core requirements for a methodology and a supplementing technology stack for agile BPM.:

- Provide best practise guidelines for the application of process templates or fragments and related artefacts. Support the selection process with context specific recommendations.
- Externalize knowledge about changes in business processes. Make this knowledge accessible to all stakeholders, but prevent information overload.
- Avoid fragmentation of the process landscape by creating duplicate or very similar processes instead of extending or adapting existing ones.

1 http://agilemanifesto.org/

- Avoid the god-object-antipattern by creating processes that have too many variations for doing “everything”.
- Offer a small, manageable set of generic and adaptable building blocks representing process fragments that can be composed into a wide variety of workflows and business processes.
- Provide software tools that adhere to high usability standards and offer an easyto- use, intuitive, and self-describing UI for creating and adapting processes and artefacts.
- Integrate analysis tools for semantic analysis and identification of recurring workflow patterns.
- Implement a central control instance to define mandatory templates, constraints and compliance rules.
- Integrate existing BPM and workflow solutions or define migration paths for their replacement.
- Support the transformation of running process instances and ontology evolution.
  - Create and maintain a common and unambiguous ontology/nomenclature for concepts, artefacts and processes. Establish migration paths or bridging solutions for existing differences in naming, for ambiguous entities, and for deviations in the perception of actual business processes.

4 Research Approaches and Existing Software Solutions

Hajiheydari and Dabaghkashani (Hajiheydari 2011) identify strategic alignment, top management support, management of people, and change management as critical success factors for BPM implementations. A wide variety of business process modelling methods (Giaglis 2001) has evolved to facilitate the transformation of domain knowledge into models, that can further be used to support the implementation of BPM software. With an increased demand for restructuring business processes and for stakeholder participation, approaches like Subject Oriented BPM (S-BPM, see e.g. Fleischmann 2012) gained popularity. S-BPM enables stakeholders to express and communicate their knowledge from an actor-driven perspective using natural language and simplified diagrams. Another way to support ad-hoc process specifications by end users is provided by Adaptive Case Management (ACM, see Swenson 2010). However, S-BPM and ACM work with a static process model that can not be adapted during execution. To overcome these limitations, Gottanka and Meyer (Gottanka 2012) propose with ModelAsYouGo a concept to collaboratively redesign S-BPM while executing a process. Kurz and Lederer (Kurz 2014) extend an ACM approach by using S-BPM for modelling case behavior.

Forbrig (Forbrig 2016) proposes to combine Continuous Software Engineering (CSE) methods, agile software development (e.g. SCRUM), Human Centered Design (HCD) and concepts of Continuous Business Process Improvement (CPI) to address the challenges of fast changing business processes. However, this approach can change processes only between at least two development sprints, as the analysts' sprint runs at least one cycle ahead of software developer sprints. On the other hand it provides greater control and professional oversight for changes and integrates well with the traditional role of analysts. Schiffner et al. (Schiffner 2014) present a conceptual design and a prototype for S-BPM-driven evolutionary business information systems (EBIS, see Neumann 2014), where process changes by stakeholders take effect immediately. They recognize process agility as the basis for organizational agility and highlight the necessity to support model management, communication/ collaboration management, and continuous process improvement. From their work it becomes evident, that further research into the handling of model inconsistencies and concepts for offloading modelling task to the end user is required.

The BPM software market responds to the challenges identified in section 3 by offering software solutions that adhere to a "low code"-paradigm by integrating visual BPM modelling capabilities into their software products. A number of providers distribute tool stacks for easily designing process models with graphical tools and for simulating, deploying and running those models. These solution are used by end users to create and run processes and workflows in a web browser or on a mobile device. Some common products are:

- Appian BPM Software includes preconfigured industry solutions for e.g. financial services, energy, healthcare, etc.[2]
- K2 Business Applications provide preconfigured domain solutions for e.g. human resource management, purchasing, marketing, and many more.[3]
- Nintex also includes workflow automation and offers standard integration with MS Office and MS SharePoint.[4]
- The Comindware Business Application Platform comes with preconfigured domain solutions for e.g. collaboration, order management, claims management, etc.[5]
- Some solutions are offered only as cloud based SaS products like Run my process[6] and Effectif.[7]

2 http://www.appian.com

3 http://www.k2.com

4 http://www.nintex.com

5 https://www.comindware.com

6 https://www.runmyprocess.com/en/

7 http://www.effektif.com

5 New Concepts for an Agile BPM Methodology

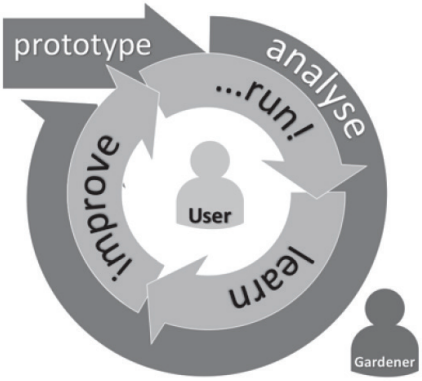

Figure 2: Agile BPM cycle

5.1 Paradigms of the Proposed Agile BPM Methodology

Our proposed agile BPM methodology is build around two core principles or values. The first one can be paraphrased with "empower and trust your users": Users are empowered to drive change based on his or her expert knowledge of the business domain. The organisation trusts them to apply this privilege wisely and responsibly.

A second core principle, "the path is made by walking", targets the emergent nature of business processes. Instead of using a Plan-Build-Run approach, we start by setting up a prototype system with an initial configuration for selected workflows. While the system is being used, users adapt and configure generic standard processes and artefacts to their needs. Domain experts ("gardeners") analyze the resulting processes and the modelling process itself (PPM - Process of Process Modelling) to identify recurring patterns and possible constraint violations to derive new, organisation

specific process templates and rules governing their application. This approach to modelling is inspired by the Oregon Experiment (Alexander 75): By the end of 1970, the campus community of the University of Oregon sought more control over their lives and their environment. After several attempts to quiet the student community, UO administration hired the Berkeley Center for Environmental Structure and its chief architect Christopher Alexander. Alexander developed radical new concepts for integrating the campus community into designing an ideal institution. One of the concepts was, to plan no paths between buildings, but let the students leave footprints on the campus. The emerging trails became the blueprint for paved roads and walkways.

Another analogy for our approach to agile BPM are modern connected navigation system, currently marketed by e.g. Tesla, Falk, or Becker. When driver deviates from the computed route because he or she knows some shortcuts or a faster routes, the system logs the alternative route along with context conditions (e.g. traffic situation, time of day, day of week, etc.). Future route calculations will consider such potential optimisations if applicable. In this way, a global model (the navigation systems' route map) will be optimised, based on local knowledge of experts (the drivers). As the navigation system collects and analyses the optimisation variants of all connected drivers, all participants will profit from the accumulated knowledge. The challenges of transferring this approach to agile BPM lie in providing a similar, near effortless way of knowledge sharing, appropriate methods for analysing collected data, and last but not least in convincing users to try unfamiliar, but potentially beneficial routes.

5.2 Stages of an Agile BPM Process

For implementing an agile BPM process we propose the following stages depicted in Figure 2:

[prototype] During an initial setup process, a generic and coarse draft for a domain specific data model and a basic set of simple workflow steps are defined. Both are based on templates and will be assembled from off-the-shelfcomponents. If necessary, adapters for integrating legacy data are provided. This results in a prototype containing data models and process models that already support simplified versions of common domain processes or workflows. This step is similar to the established BPM cycle but significantly less complex and extensive. To jump-start the learning process, key performance indicators are defined during prototype setup. These indicators comprise e.g. the lifetime of a process instance or the number of steps for reaching a given target state.

[run!] With the prototype established, users will instantly perform at least some of their work using the new system. As in other BPM systems, they will interact with process artefacts using form based user interfaces. Active process instances can be modified and extended by adding data fields the forms. Those interventions extend the data model for a single process instance. Another way to enrich the process model consists of adding arbitrary pre-defined process steps as consecutive actions to the process instance and assigning the co-worker best fitting to the implied task. That way, each users can delegate work items to others and define what needs to be done. This will result in a number of implicitly derived data and process models and can be done without explicit modelling task our support from intermediaries like analysts or process managers.

[learn] During the live cycle of each process instance the software monitors changes to data and process models. A basic recommender system supports users by suggesting frequently added data fields and process steps. At first, selection and ranking of recommendations will be based on similarities between process instances and the monitoring of the defined key performance indicators. After this cold start phase, the input of process gardeners will be used to refine the recommendation process. The result of the learning stage is a continuously improving statistical model of the usage and the performance of different process instances.

[analyse] Process mining is the key for understanding actual processes and changes in the process landscape over time. By integrating process mining as an ongoing and parallel activity, process gardeners receive continuous updates on all process models and can intervene if necessary. They can figure out under which circumstances additional data fields or workflow steps were added, why and when paths of work items changed and which model variant might be most appropriate for efficiently managing a given process. These insights are used to optimise the recommender system and to restrict user choices where necessary(e.g. to enforce compliance rules).

[improve] Backed by statistical data and knowledge, users can continuously improve their way of performing or changing processes and organizing their work. They are guided by the same software they use for performing their actual tasks, not by a separate tool or an external process documentation. And they remain free to create exceptions for selected process instances whenever necessary. Process gardeners resemble the necessary counterweight to keep the BPM system in balance by maintaining a global view on the process landscape. Their actions are based on process mining and they decide and define:

- Which data fields of process artefacts become mandatory under specific conditions.
- Which roles and users are allowed to perform certain process steps.
- Which process steps become mandatory and are exempt from possible exceptions.
- Which areas of the process landscape are designated to receive a higher or lower degree of freedom and agility.
- Which process flow becomes “best practice” will rank higher in recommendations to users.

5.3 Mitigating Expected Risks of Agile BPM

Besides the benefits of agile BPM, like an optimised fit between process models and actual processes and faster adoption of process changes, we anticipate a number of risks where mitigation strategies will have to be implemented:

- Creating or adapting local process fragments is done by users who do not necessarily consider implications for the whole process chain and act on local knowledge and context. This can cause inefficiencies or even deadlocks when process instances traverse department boundaries as local optimisations might conflict with a better global solution. Especially the implementation of complex and extensive processes contradict our approach of using local design optimisations and can lead to byzantine process landscapes that are difficult to use and to maintain.
- Even if users do not explicitly model business processes, empowering users to adapt and shape IT solutions requires an elevated degree of expertise. This extends to knowledge about processes and their dependencies and a deeper understanding of the business domain, as well as to general proficiency in working with IT systems. As the re-assignment of process responsibility to end users is a core paradigm of agile BPM, our proposed method might not be suitable for every user.
- Special attention has to be given to the integration of legacy systems, as a suboptimal design of bridging and adapter layers might lead to additional risk for keeping the adaptations in line with continuously evolving processes.

5.4 From Process Managers to Process Gardeners

The conventional BPM cycle assigns a central role to process managers and hold them responsible for aligning business processes to the strategic and operational requirements of the business model. Particular tasks of this role are:

- Maintain an overview perspective in relation to the general context of an organisation.
- Orchestrate the interaction of particular stakeholders.
- Ensure efficiency, effectiveness and compliance.
- Specification and operation of IT applications to support relevant business processes.

One essential drawback of this centralized approach is the inherent risk of process managers becoming a bottleneck for changes and potential dissociation from operational requirements. As a result, the BPM process slows down and processes do not reflect business needs in an appropriate manner.

Agile BPM relocates process managers and introduces a perspective shift. A process manager is no longer a gatekeeper but becomes a process gardener. Instead of designing and selecting processes, he or she has to supervise and guide others. Their changes mostly originate from operational requirements. By analyzing and continuously monitoring the evolving process landscape, a process manager can gain insights into those changing requirements and has to derive methods for keeping processes streamlined and aligned to strategic goals and compliance requirements. To fulfill his/her responsibilities different instruments for shaping and taming the growth of the process landscape are available:

- Restrict a users' capabilities for modifying data models and process steps.
- Modifying parts of the data and process model.
- Define and enforce model constraints.
- Modification and configuration of the integration layer for legacy applications or external services.
- Definition and communication of process metrics.
- Configuration of the recommender system.

The process gardener uses the same software tools as a regular user, that is the BPM application itself, supplemented by analytic and visualisation tools for process mining.

6 Conclusions

The fact that BPM concepts addressing the agile transformation of business processes (e.g. S-BPM and "low code BPM") are transformed into maturing products that currently move into the market shows the demand for more flexible BPM solutions. Also the desire for structural guidance of knowledge workers that preservers freedom and agility underlines the need for an agile end-user driven BPM approach. We described and discussed key features of a BPM methodology that empowers end users to create and modify running processes by manipulating process artefacts without explicit modelling and derived requirements and concepts for implementing this approach. Essential parts of these concepts are currently evaluated with one of our customers and show high potential for supporting more agile business processes. However, further research issues comprise:

- How can legacy integration be encapsulated by an agile BPM solution?
- What are the most effective methods for a process gardener to intervene while users work within a self learning process environment?
- Where are the conceptual boundaries of agile BPM?
- In which business areas (industries, domains) agile BPM can deliver the expected benefits.
- How can the benefit of agile BPM be evaluated and proven?
- Which additional risks do arise from implementing an agile BPM approach?

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