Introducing Semantic Services for Continuous Agile Enterprise and Process Modeling

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Abstract. This article is a final report of process enhancement project in one of the leading Russian banks. It was done with the set of tools and techniques for enriching process models with semantic information and adjusting them on request. We propose an approach for binding these models with corresponding documents and expert profiles define factors that trigger models' changes using company's information field.

Keywords: Agility; BPM; Context-awareness; Process modelling.

1 Introduction

Changes in client behavior towards application of services drive banks to rethink their financial strategies and digitize their value chains. In the past digital disruption occurred on levels of discrete product and service technologies (e.g., online banking). Today, it occurs on the level of ecosystems and the banking business model is a good example of this change. Current banking customers look for agility and the bank's value proposition depends on building ecosystem-level strategies that encompass many partners that should be able to react quickly on customer trends.

Nowadays, neither their BPM office nor process managers or valuable process participants cannot predict process changes that appear due to execution variability. Brander et al. [3] claims that gaps between process specifications and practical requirements are inevitable and noncompliant behavior occurs to bridge this gap. Melão and Pidd [4] recognize that social interaction fosters debates and collaboration and, thus, deviations from intended structures need to be expected. Intended noncompliance, often in the form of workarounds, receives considerable attention in literature, cf. (Alter [5]; Röder[6]).

Since those changes are not detected in advance and become visible only after customer complains - it causes potential financial and image risks to the company. Furthermore,

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changing customer expectations expends this gap and nowadays more flexibility required from employee's performance often driven by the context. For the bank analyzed we covered this gap, by application of the *context-aware modelling approach* [1].

To detect the main obstacles for current process modelling in industries we interviewed more than 70 companies in various economic sectors in Russia [1]. We identified that the major constraints refer to lack of understanding of modelling value and absence the appropriate mindset (see Figure 1).

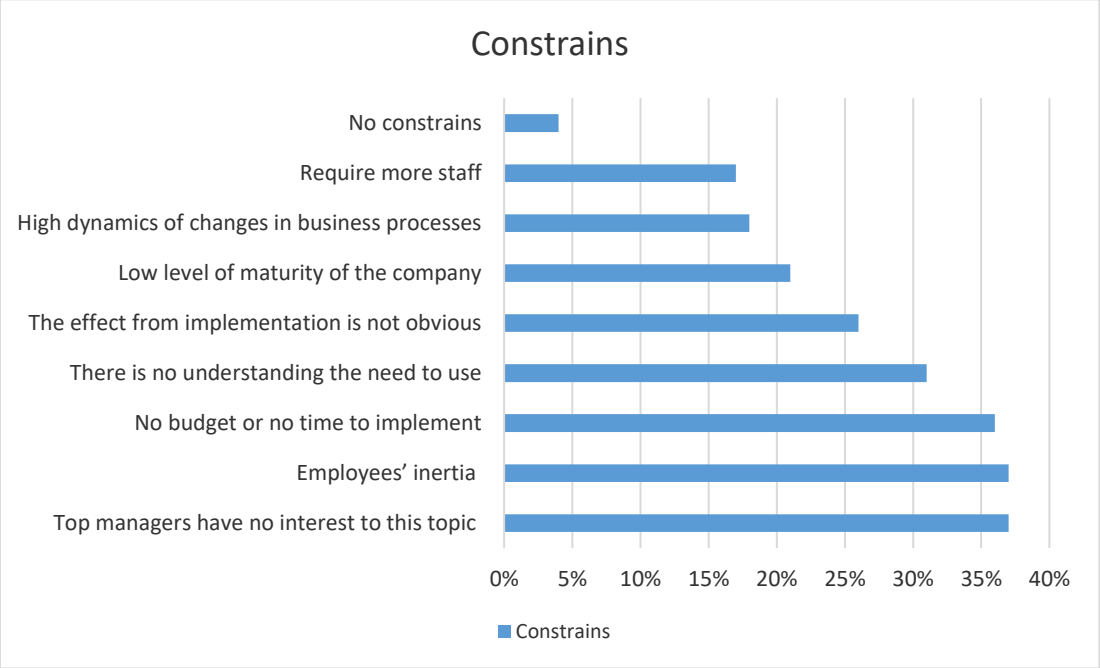

Fig. 1 Modern constrains for business modelling

We claim that to overcome the above modelling challenges we require the new approach to enterprise modelling exactly the one we applied in the case study.

2 The case study

The bank we consulted provides a full range of financial services in Russia in consumer lending. It has a large network of touchpoints including branches, ATMs, loan officers that serve 5 million customers by 30 000 employees. Its business goals are decomposed from the strategic level to the level of business process design through specifications.

On this level, all business processes are described with the accuracy required to implement them on the production level. Due to the competitive struggle, bank faces many challenges with respect to the management of its business processes, e.g.:

- noncompliance with current process models and specifications
- deviations from established work procedures.
- both options above impact KPIs

We decided not to concentrate on developing perfect process landscape, but to deliver models that are useful in a period on time [1]. Therefore, we formulated the main requirements for our approach in this Bank:

1. cross-organisational ad-hoc collaboration
2. iterative task resolution
3. workflow supports changes
4. every employee can initiate an improvement and get support by experts
5. decisions are the outcomes of collaborative processes

The proposed approach involves following steps to make enterprise models evolving synchronously with the changes (see Figure 2) [2]:

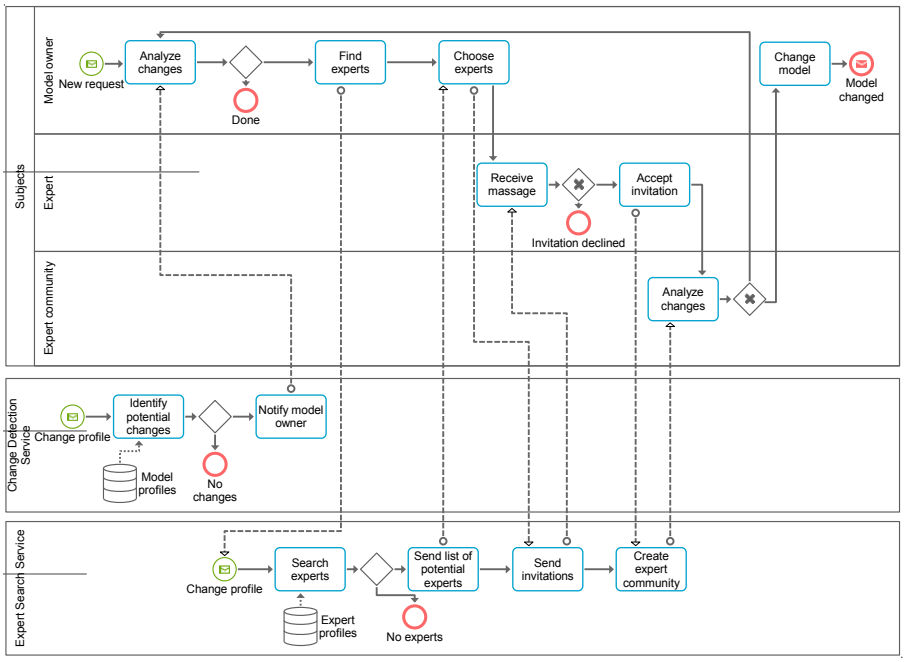

Fig. 2 Swim lanes of context -aware business processes

Context-aware process management identifies preconditions for potential changes and ensures quality process execution. That is why, in the context-aware process paradigm any deviation from the model is not an exception but an expected option to detect *implicit* process changes. They are mostly caused by noncompliant behavior of employees, that includes skipping activities, performing additional activities, outdated procedures, lack of staff, outdated equipment, fatigue, inexperience or performing activities without proper authorization, etc. There is also malicious behavior such as lying, cheating, and stealing for the personal benefit or overcoming inadequate IT functionality or other obstacles and preventing future mishaps. Unintended behavior occurs in the form of mistakes and often due to a lack of knowledge about procedures. Implicit changes may not show themselves for a long time, often they can be identified only by experts. If they are not identified in advance they create operational risks for the system process model.

2.1 Information field analysis

To identify these changes, we provide natural language processing of all specifications and key terms stored in employee's emails and document attachments. Enterprise architecture in practice is often left unstructured, being more represented through the *information field* generated by employees. This field encompasses live communication in natural language within the ad-hoc tasks, e-mail correspondence, chats, and various types of documents (policies, tasks, actions). Companies who analyze their information field regularly might identify emerging change-requests in advance.

One of the main elements of text mining is *corpus* – a huge structured set of texts, usually containing tags with morphological (POS-tags) and syntactic information. In our case, corpus is based on relevant terms and messages containing model-related terms identified by experts. Original text is tokenized – divided into parts, minimal fragments (not always words!): words, stable phrases, prepositions ('because of'), abbreviations ('e.g.') and so on. A special list of words and elements (usually punctuation, the most common and the rarest elements of the text, interjections, etc.) called "stop words" is skipped. After that, tokens are lemmatizing - presented in the initial form ("better" -> "good"). It is important to identify what part of speech is token and what meaning it has, otherwise lemmatization may be done in a wrong way. POS-tags in corpus help to get morphological information about elements of our text. For syntactic and semantic analysis, a vector form of words/sentences/documents is often used – they are presented as a point with coordinates in space. Word–context, pair–pattern and term-document matrix may be created. Vector model allow to compare documents and words, to define their similarity, to recognize patterns and association rule (famous example: "king" - "men" + "woman" = "queen"). There are several types of vector document models, for example: Random Projections (RP), Latent Dirichlet Allocation (LDA), Hierarchical Dirichlet Process, (HDP). For words vectorization, a Google's instrument "word2vec" may be used. At the final step, the algorithm is learned on our corpus and then works with our text, our data, making morphological, syntactic and semantic analysis.

The results of work of the linguistic engine are used in Change Detection service and Expert Search service.

2.1.1 Change Detection

The Change Detection service is intended for continuous monitoring of the organizational unstructured content to identify changes, associated with the emergence of new themes, events, and description of the domain objects. This set of documents would be the main data source for change control: it should be regularly updated with new documents, created by employees. It also could be fully substituted by a new set of messages, collected inside the expert network. Its service interface allows prediction of changes. This information is a set of new terms associated with a model. For handling process exceptions and cases when higher knowledge from process actors is needed for decision making, we applied expert search service.

2.1.2 Identification of experts

An Expert search service parses the document content and returns the list of persons sorted by their discovered capabilities in this query topic. Searching for experts aims to assess the "tacit knowledge" in organizations through artifacts of "explicit knowledge": organizational documents associated with the model. The tacit knowledge of multiple experts is combined with explicit information from project databases, documents, manuals and other external sources. It uses the confirmed hypothesis that person's qualification strongly correlates with set of characteristic concepts which he uses; these terms are specific to the industry. Considering relative frequency of term usage and many other factors, our approach can identify the true experts. Significant terms have strong non-uniform distribution of relative frequency of usage among employees, and common ones – approximately identical relative frequency of application. It can be used:

- To find potential experts giving a new content as input. It's possible to send a message to each expert with the request when the advice in the new process part is urgently required.

- To form expert communities for analyzing changes and adjusting process models. Newly-established team estimates work volumes, decide on priorities, and decide whether the change is important based on change context (annotation).

3 Conclusion

As we have figured out, the classical process modelling approach suffers from the lack of process models robustness when the changes are not precisely identified. This paper makes two contributions:

a. an original changes identification method, called Context-aware process modelling, that solves several challenges through the annotation of models with experts and artifacts
b. two independent services: Change Detection and Expert Search that support the business processes management by integrating semantic technologies into models.

Currently we are working on self-adapting business process intelligence system that evaluates and selects best possible process scenario for process execution in the real-time, supported by the accumulation of semantically described processes in the process repository, using the services presented in this case study.

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