



CENTERIS 2012 - Conference on ENTERprise Information Systems / HCIST 2012 - International Conference on Health and Social Care Information Systems and Technologies

## Aligning Business Processes and Work Practices

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### Abstract

Current business process modeling methodologies offer little guidance regarding how to keep business process models aligned with their actual execution. This paper describes how to achieve this goal by uncovering and supervising business process models in connection with work practices using BAM. BAM is a methodology for business process modeling, supervision and improvement that works at two dimensions; the dimension of processes and the dimension of work practices. The business modeling component of BAM is illustrated with a case study in an organizational setting.

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*Keywords:* Type your keywords here, separated by semicolons ;

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### 1. Introduction

Current Business Process Modeling (BPM) methodologies are supported by data collection techniques including interviews, surveys, text/document analysis, among others. BPM emphasizes process notions (workflow, decision, information, activities) as the dominant dimension [1]. However, BPM would benefit from a better understanding of other elements that contribute to process execution such as interactions between activities, people, products, information and other resources. Indeed, it has been argued that existing

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BPM methodologies offer little guidance in keeping up-to-date the continuously evolving knowledge coming from business process execution [2]. Business processes are executed through human and automated activities. Whereas many business processes are fairly static only at a high level, at finer-grained levels such as activities, are more agile and unpredictable. Moreover, many organizations do not know their end-to-end processes accurately or in detail, since the knowledge required for its execution is tacit and decentralized [3]. Recent research in BPM is aiming to address the unpredictability of business processes [4,5], but there is yet little guidance in how to address the problem of tacit knowledge and business process model maintenance.

What appears to be unpredictable behavior does not mean chaos. Indeed, it follows certain rules. From our point of view, the rules followed in the execution of activities and tasks can be uncovered by capturing work practices. Work practice is a concept that originates in socio-technical systems, business anthropology, work systems design, and management science [6]. Work practices are the behaviors expressed as action patterns of *specific* individuals, performing *specific* activities, in *specific* circumstances. Work practices involve people engaging in activities over time, not only with each other, but also with machines, tools, documents, and other artifacts. The importance of discovering work practices to improve user support has been acknowledged in [6,7].

Work practice modeling is also important in (1) providing a deeper understanding of the human activities composing business processes, and (2) assessing the alignment between process models and actual execution [8]. This paper describes how to model business processes aligned with work practices with the Business Alignment Methodology (BAM). BAM represents a multidisciplinary approach that allow business analysts to improve business processes discovery, monitoring and analysis, paying attention not only to process but also to product, information and human dimensions through actual work practices. BAM development follows a design research approach [9]. Design research enables building and evaluating artifacts such as models and methodologies.

The remainder of this paper is organized as follows; section 2 summarizes related work on business process modeling and work practice modeling. Section 3 summarizes the Business Process Discovery (BPD) phase of the BAM methodology. Section 4 illustrates the BPD phase of BAM with a case study in a real organizational setting. Section 5 outlines our conclusions and outlook.

## **2. Related Work**

### *2.1. Business Process Modeling*

Several BPM frameworks describe the ways of building business process representations. Some approaches are systematic and detailed methodologies encompassing a set of procedures, techniques and tools to support the business process model construction. BPM methodological procedures involve of several steps and include descriptions of the inputs and outputs of each step [10,11]. Data collection techniques involve combinations of techniques drawn from the field of qualitative research e.g. focused interviews, workshops and surveys. In some cases, templates to support data collection are provided to facilitate the recording of the model components (e.g. list of human and automated actors) and the relationship between them (e.g. actors of a given activity).

The semiotic-based approach developed by Dietz [12] provides a language-action perspective (LAP) methodology that guides the construction of business process models. Data sources are textual descriptions of the enterprise operation (no specific collection techniques are provided). Dietz conceptualizes operations at 3 levels; (1) *performa* (data), (2) *informa* (information) and (3) *forma* (transactions). Once collected, the descriptions are analyzed using two techniques (*performa-informa-forma*) and *coordination-actors-production analysis*) that perform a semantic analysis of these descriptions. In the former, sentences

corresponding to the *performa*, *informa* and *forma* levels are distinguished with different colors. The latter uses different types of brackets to distinguish *actors*, *coordination acts* and *production acts*.

## 2.2. Work Practice Modeling

Research efforts in work practice modeling aim at supporting system development. Pomerol and Brézillon developed a context model and representation language [13]. A premise of this work is that the main distinction between operational practices is the *context* where these practice apply. Their model of context relates the notion of context and knowledge. Sierhuis [6] propose an activity-based multi-agent modeling environment to model work practices. The authors develop a notion of situatedness supported by the following concepts; (1) *people* and *knowledge*, (2) *situated action*, (3) *situated cognition*, (4) *situated learning* and (5) *autopoiesis*. As a result, the representation language BRAHMS (Business Redesign Agent-based Holistic Modeling System) was developed to model knowledge in situated actions and learning in human activities.

These approaches regard the particularities of the agents performing activities and situations. Nonetheless, they were created for systems development purposes. Consequently, the set of concepts provided require specialized skills and are thus too complex for the non-technical personnel typically involved in organizational analysis. Another aspect not addressed is work practice modeling methodologies. Lundberg and Berquist [14] describe a combined ethnographical approach to capture work practices, but also for system development ends.

## 3. Business Alignment Methodology BAM

BAM proposes a two-dimensional approach, encompassing three phases : (1) Business Process Discovery, (2) Business Process Supervision and (3) Business Process Assessment and Improvement. Business Process Discovery provides an initial process specification through interviews and collaborative methods. Business Process Supervision assures that daily practices follow base business process models. Business Process Assessment and Improvement allows analyzing performance measures to improve and refine business process models. Since the goal of this paper is to illustrate results from the Business Process Discovery phase and due to space limitations, we will only describe in detail the first phase in the next section (for a complete description see [15]).

Each phase integrates two dimensions: (1) Process and (2) Practice. The Practice dimension explores day-to-day work based on individual actions and practices. This dimension captures and represents on-site information needed to systematically validate business process models, eliciting the knowledge of operational actors (represented by individuals or groups). At this level, knowledge is local and frequently tacit, thus it is hard to formalize. However, it encompasses information needed to validate process execution. In the Process dimension, business analysts discover, review and improve business process descriptions, based on information from the Practice dimension. The process dimension addresses knowledge that crosses functional divisions and organizational boundaries (clients, suppliers). Therefore, it is not confined to particular individuals or groups. The process dimension also addresses the need of continuous business process supervision and improvement as a reaction to fast-changing environments. These two dimensions, Practice and Process, will ensure the proper structure to articulate individual, group and organizational knowledge with the knowledge of business analysts.

### 3.1. Business Process Discovery

The main goal of a Business Process Discovery (BPD) is to get personal descriptions of business processes from work practice descriptions. BPD phase aims at developing an organizational profile of people, activities, technology, and information in order to capture actual business processes. This phase includes two main sub-phases: (1) Learning (Eliciting) Business (LB) and (2) Modeling Business (MB).

#### 3.1.1. Learning Business Phase

The Learning Business phase encompasses three activities; (1) kickoff meeting, (2) eliciting information of practice and process, and (3) elaborating preliminary practice and process descriptions. The kickoff meeting communicates operational actors the goal and procedures of the BPD phase. Information elicitation is accomplished according to the nature of each dimension. The outcome of this sub-phase is preliminary descriptions of both work practices and business processes.

**Practice Dimension.** In our framework, work practices are defined in terms of action patterns, that is, recurrent action sequences. Due to its local nature, work practices vary according the context of execution. Moreover, operational actors are often unaware of their recurrent action patterns. Hence, instead of conducting standard interviews and workshops, the approach to elicit work practices is accomplished as follows: (1) Capturing daily actions, (2) Identifying action and interaction contexts created by related actions, and (3) discovering recurrent action patterns within contexts.

Capturing daily actions creates action repositories, where each action is registered as *<actor, action, resource>* triples. Actions refer to fined-grained operations of actors' daily work. Actions are identified with verbs taken from the vocabulary shared among operational actors. Resources may involve information, tools, materials or even human knowledge not yet externalized in external sources. Resources are described with nouns or nominal phrases using actors' own vocabulary. Actions may be communicative or not communicative. Communicative actions involve two actors; a sender and a receiver.

Understanding the meaning of actions requires situating them in a particular context. Drawing from the sociological notion, **action contexts** are defined as situations created by action streams performed by one or more operational actors. Action streams performed by a single individual create **personal action contexts**. Interaction streams i.e. communicative actions exchanged between two or more actors that are part of a single conversation, create **interaction contexts**. Under this definition, action and interaction contexts are uncovered by grouping sequences of actions related to a given situation. Once identified, contexts are analyzed in order to discover recurrent action patterns within them. It is noteworthy that action and interaction contexts and patterns are not generic. Rather they refer to specific persons, places a time periods.

**Process Dimension.** The action patterns discovered at the practice dimension are then analyzed and discussed by operational actors and business analysts in order to define business processes, as well as the business activities and resources, composing business processes. This discussion entails an aggregation process that is accomplished in a bottom-up fashion. However, a top-down application of high-level knowledge such as organizational goals and strategies is required to complete business process definitions.

#### 3.1.2. Modeling Business

The subphase Modeling Business, involves several stakeholders (business analyst, process owner, organizational unit responsible and operational actors) that perform three interrelated activities (1) model construction; (2) model revision and evaluation and negotiation and (3) model approval. These activities support a negotiation process that if successful, results in a shared view of the process. Finally, the model

approval activity concludes when the participants approve or reject the model. Modeling techniques vary according the dimension.

**Practice Dimension.** The action and patterns identified within particular contexts in the previous phase are shared, discussed among operational actors and business analysts involved in similar activities in order to identify which practices yield better results.

**Process Dimension.** The process representation concerns activities, resources, decision points and work flows (topology). In the Process dimension, business analysts use the best practices that lead to business process reviews and improvement. Business analysts then define business process models based on previously identified best practices.

#### 4. Case Study

##### 4.1. Organizational Evaluation

The Business Process Discovery phase of the methodology was tested a software development team of 4 programmers and the project leader, who performs both programming and project management tasks. The team develops web applications for a commercial bank. Team members perform systems analysis, design, programming, test and maintenance activities. During the observation period, the team worked on the following applications; (1) Suppliers, (2) Claims, (3) Client correspondence management (called Mail application), (4) Evictions and (5) Marketing Campaigns. Being a key user and a small case, the team manager worked also as the business analyst. The team manager's chief played the process owner role.

##### 4.2. Business Process Discovery Results

The research goal and data collection methods were discussed in a briefing session. Worksheets with templates to registered actions were distributed. In order to achieve some standardization regarding the terms used, the meeting also served to discuss typical action names and resources.

n°	day	Actor/Sender	Receiver(s)	action type	description	tools	documents  information	human
1	6	Carla	team members	propose	a team meeting at 15h	e-mail	team member addresses	
2	6	Carla	Mariana, Catarina	inform	error in automatic table updates	e-mail	error message	
3	6	Carla	Catarina	command	find a solution to the automatic table update problem	e-mail	Catarina' address	
4	6	Carla	CG team	propose	test claims application (integration tests)	telephone	CG team tlf. number	
5	6	CG team	Mariana	accept	test claims application (integration tests)			
6	6	Carla		prepare	prepare claims application test environment	claims application	test data	claims application knowledge (testing procedure)

Fig. 1. Some registered actions

**Learning phase - Practice dimension**

A set of 534 actions was manually collected through a three-week observation period. Figure 1 shows an extract of an action log that illustrates the structure defined for actions. Due to human multitasking, grouping actions in personal contexts is essential to distinguish related from unrelated actions. This discrimination use achieve with the notion of personal contexts. Personal contexts are discovered by grouping together action sequences. Such actions are performed by a single individual and belong to a given situation. Such groupings allow defining context features such as frequent action types and resources, and labeling each context. Figure 2 shows the personal contexts identified for Carla and Alexandre, two participants of our case study.

Person_Name	Context_ID	Context_Description
alexandre	a1	Data Collection for Mail Application
alexandre	a2	Mail Application Programming
alexandre	a3	Evictions Web Service Problem
alexandre	a4	Team Meetings
carla	c1	Common Services Application Programming
carla	c2	Programming support
carla	c3	Team Meetings

Fig. 2. Personal contexts of Alexandre and Carla

Nonetheless, to properly understand execution, it is not enough to model personal contexts and individual behaviors. Indeed, tasks are executed by several individuals. Thus, it is necessary to identify and characterize not only personal contexts but also, interaction contexts. The analysis of interaction contexts allows capturing which actions and resources are shared (and how) between different individuals.

N°	day	gent (sender)	dst	agent (receiver)	action	description item keywords
1	9	evictions-w	-	alexandre	request	solve problem, evictions web service
2	9	alexandre	a3	NULL	solve	solve problem, evictions web service
3	9	alexandre	a3	mariana	request	publication in quality environment, evictions web service
4	9	mariana	m6	publication team	request	publication in quality environment, evictions web service
5	9	publication	-	mariana	inform	publication, evictions web service
6	9	mariana	m6	alexandre	request	test, web service, quality environment
7	9	alexandre	a3	NULL	test	evictions web service, quality environment
8	9	alexandre	a3	mariana	request	publication, production environment, evictions web service
9	9	mariana	m6	publication team	request	publication, production environment, evictions web service
10	9	mariana	m6	publication team	ask	evictions web service, production environment
11	9	publication	-	mariana	answer	evictions web service, published, monday
12	9	mariana	m6	alexandre	inform	evictions web service, published, monday
13	9	alexandre	a3	evictions-ws user	inform	evictions web service, published, monday
14	17	evictions-w	-	alexandre	request	test, evictions web service, development environment
15	17	alexandre	a3	mariana	request	publication, evictions web service, quality environment
16	17	mariana	m6	publication team	request	publication, evictions web service, quality environment
17	17	publication	-	mariana	inform	publication, evictions web service, quality environment
18	17	mariana	m6	alexandre	inform	publication, evictions web service, quality environment
19	17	alexandre	a3	NULL	test	evictions web service, quality environment
20	17	alexandre	a3	mariana	request	publication, evictions web service, production environment
21	17	mariana	m6	publication team	request	publication, evictions web service, production environment
22	17	publication	-	mariana	inform	publication, evictions web service, production environment
23	17	mariana	m6	alexandre	inform	publication, evictions web service, production environment
24	17	alexandre	a3	NULL	test	evictions web service, production environment
25	17	alexandre	a3	web service user	inform	evictions web service, in production environment

Fig. 3. Evictions Web Service Action Stream

Whereas personal contexts are identified from action streams of a single individual, the identification of interaction contexts is made from action streams from *two* or more given individuals. Interpersonal contexts relate two specific personal contexts of interacting individuals. Figure 3 depicts an action stream created by a

problem detected on the "evictions web service". This action stream involves several interactions between Alexandre's personal action context **a3**, and Mariana's personal action context **m6**. This action stream shows a set of communicative actions exchanged mostly between Alexandre and Mariana in day 9 and day17. This action stream starts when Alexandre receives a request so solve a problem in the "evictions web service". After solving the problem, Alexandre requests Mariana to publish the modified web service in the quality environment. This action stream shows the interaction context created by the actions related to the Evictions web service software publication.

Table 1 illustrates some interaction contexts identified by analyzing action streams as described for the Web Service action stream illustrated in figure 3. Each interaction context is identified with a code, the personal contexts associated to it, and a description. The action stream in figure 3 corresponds to the interaction context **ic4**, is composed by the personal contexts **a3-m6** and is described as the "**evictions web service problem**".

Table 1. Some interaction contexts

Interaction Context	Personal Contexts	Description
ic1	<a1- x>	data collection for mail application
ic2	<a1-m011>	cards information collection
ic3	<a3- m6>	evictions web service problem
ic4	<c2 - a5>	Web services and mail app. support
ic5	<c2 - m8>	suppliers app. support
ic6	<g2 - t3>	suppliers app. support

Identifying interaction contexts allows uncovering recurrent actions sequences or patterns. Identifying action patterns allows assessing how different groups execute activities and how they differ from pre-defined activities composing business process models. With the data collected, it was possible to identify action patterns within some interaction contexts (Table 2). It is important to notice that actions in italic represent actions that do not appear within some but not all sequences. Its presence was inferred from on the fact that they needed to be executed in order for the remaining actions to take place.

Table 2. Some action patterns

ID	Context Name	Action Pattern
ic5	suppliers application support	1.request (help) - 2.help
ic6	suppliers application support	1.ask - 2.answer
ic7	suppliers application support	1.request (help) - 2.help 1.request (solve) - 2.solve
ic8	team meetings	1.propose - 2.accept - 3.assist
ic9	project management reports	1.request (update) - 2.update-3.send
ic11	integration tests	1.request (test) - 2.test 1. inform(test results) - 2. test
ic16	software publication	1.request (publication) - 2.perform (publication) 3.test - 4.inform (publication) 5.inform (publication)- 6.inform(publication)

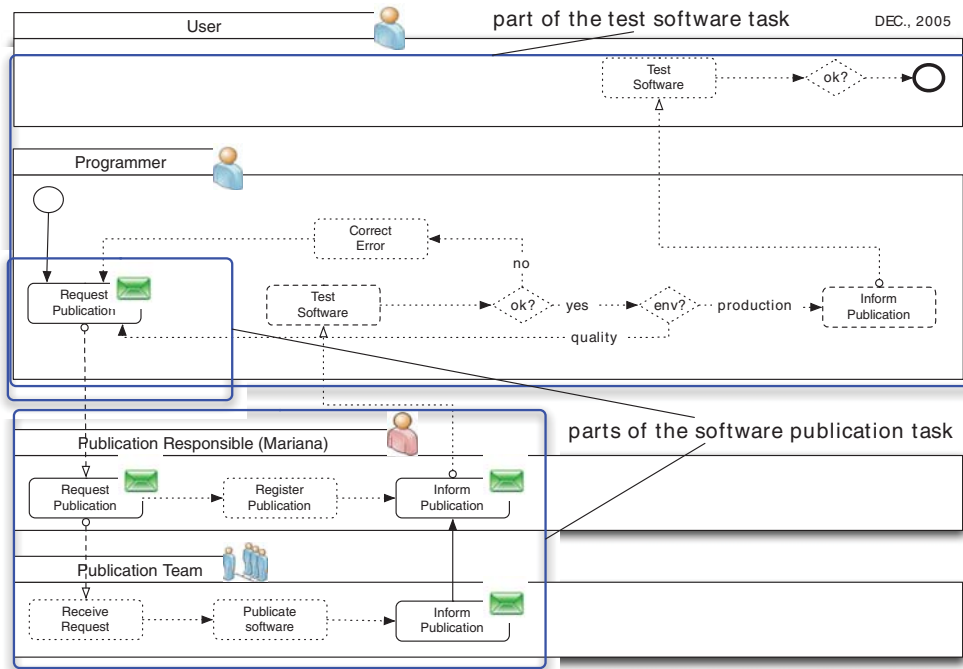


Fig. 4. Publication practice

### Learning subphase - Process dimension

Action patterns uncovered at the Practice Dimension can be used in a bottom-up fashion to discover actual business activities, processes, and resources. However, in this case, the organization had previously accomplished a business process modeling initiative, having already identified a list of pre-defined activities composing business processes. Hence, in this case, action patterns were associated to those activities. The activities related to the action patterns identified in Table 2 are: (1) Test application components (**ic11**), (2) Publish application components (**ic16**), (3) Support users (**ic5**, **ic6**, **ic7**), (4) Elaborate project reports (**ic9**), and (5) Monitor Project Progress (**ic8**).

### Modeling subphase - Practice dimension

Action patterns found in specific contexts allows uncovering action patterns of specific individuals or groups. For example, figure 4 depicts a publication practice. This practice was uncovered from the action pattern found in interaction context **ic16**. Notice how practices are specific to particular persons and tools used by them. It is also noteworthy that a practice maybe related to more than one formally defined activity. The publication practice includes actions belonging to two pre-defined business activities; (1) test and (2) publish software components. Actions depicted in solid-line boxes are actions present in the repository. Traced-line boxes represent actions not always present but presumed to be performed always. Dotted-line boxes are actions never registered but inferred from registered actions.

### Modeling subphase - Process Dimension

After collecting diagrams representing several practices, the team discussed them and selected the best practices. Best practices were then used to build a software development process to be shared by all teams. Figure 5 depicts a process model resulting from this phase. Figure 5 shows the process that resulted from putting together the best practices related to software development, or from redefining current practices.

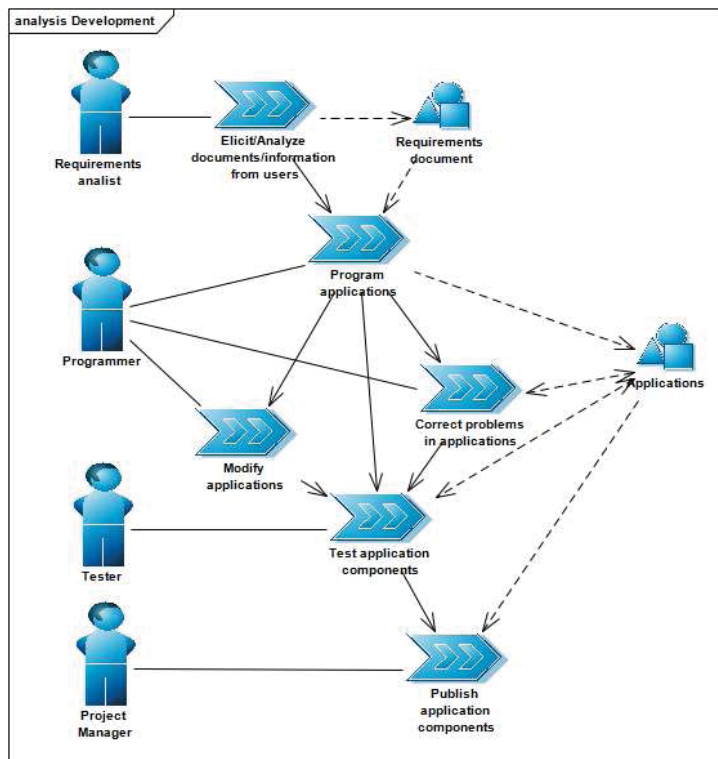


Fig. 5. Generic Software Publication Process

### Case discussion and evaluation

The results of this case were qualitatively evaluated through a non-structured interview with the team members. This interview allowed discussing the results achieved, and summarized below:

- The information acquired from the action repository was very rich and detailed. Even missing actions were easily inferred and 'filled in' the representations.
- Registering actions manually was time consuming, restricting the number of actions registered, as well as the registration period.
- The action capture effort was partially compensated because it minimized the need of interviews, as well as meetings, and the time spent by external observers at the organization.
- Diagrams were considered accurate, and needed few or any corrections at all. Work practice diagrams were considered very useful in providing a common ground to discuss and compare the practices employed with other teams, and with formally pre-defined activity models composing business processes

## 5. Conclusions and Outlook

This paper describes to model and supervise business processes aligned with work practices. Driven by the decentralized, tacit and dynamic nature of business processes, BAM's design is structured in three phases and two dimensions. This paper illustrates the Business Discovery phase through a case study conducted in a real organizational setting. Case evaluation was conducted through interviews with all participants. All operational actors found the action repository was very rich and detailed, where missing actions could be inferred to 'fill in' practice representations, including practices they were previously unaware of. Both the team manager (business analyst) and the supervisor (process owner) indicated that having work practice descriptions was very helpful in discovering business processes. More extensive case studies encompassing the whole methodology, provided with formal evaluation techniques are required in order to show not only how to discover, but also how to supervise the alignment between existing business process models and work practices. An exploration and development of automated methods for data collection and analysis is also essential in order to enable larger and longer case studies.

## Acknowledgements

This article was partially financed by Fundação para a Ciência e a Tecnologia.

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