



## AGILE BPM IN THE AGE OF CLOUD TECHNOLOGIES

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**Abstract.** This article is focused on application of agile principles during adoption of Business Process Management (BPM) in an organization. We propose some agile techniques for gathering requirements and iterative process design. Such techniques help to obtain realistic processes which are easily adaptable to changing business requirements and do not restrict organization's flexibility. We also discuss general obstacles of BPM adoption process identified by a related research, which confirm the necessity of more systematic approach to BPM adoption process. Further we present an outline of our methodology for agile BPM adoption, which propose a collaborative approach to process design with help of Process Collaboration Environment. At the end we discuss how Cloud technologies can foster BPM agility.

**Key words:** Business Process Management, Agile BPM, Adaptive Case Management, Small and Medium Enterprises, BPM adoption methodology, BPM framework, Collaborative process design, Business analysis

**1. Introduction - Role of BPM in agile enterprise.** The purpose of the article is to present Business Process Management (BPM), often considered a rigid approach to managing the organization in agile context. Despite the fact agile manifesto refers to : "Individuals and interactions over processes and tools" [29], we want to present some agile approaches to BPM which show that business processes designed and managed with agility in mind can actually foster interactions and provide hospitable environment for flexible collaboration. This article discusses how BPM can be successfully adopted with respect to agile principles and improves organization's efficiency without loss of flexibility.

To preserve business flexibility we have to carefully maintain the link between organization's processes and organization's strategy and goals [19]. We discuss how to react quickly to any changes in business requirements and reflect them quickly in organization's processes. In today's dynamic business environment, such changes happen often, usually initiated by change of customer requirements or situation on the market [1]. We also discuss how to track the impact of process changes by gathering process data and use them as an input for further processes improvement [5].

Adoption of "agile BPM" is especially relevant for Small and Medium Enterprises and Organizations (SME) who can benefit from BPM as well [3]. For such organizations flexibility is often important competitive advantage.

At the end of this article we outline methodology for performing agile BPM adoption and discuss how can modern Cloud technologies simplify the BPM adoption process and provide useful technologies which help with technical aspects of BPM and reduce cost of technical implementation of a BPM solution.

### 2. Background.

**2.1. Enterprise agility and BPM.** Dynamic changes of global market of today significantly elevate the importance of enterprise agility. The paper [4] defines Enterprise agility as an ability to detect opportunities for innovation and seize them by assembling requisite assets, knowledge and relationships with speed and surprise.

Business processes have strong relationship to organization's operational agility, which reflects the ability of organization's business processes to accomplish speed, accuracy and cost economy in the exploration of opportunities for innovation and competitive action. In such way organizations can rapidly redesign the existing and create new business processes for exploiting dynamic marketplace conditions [22]. Thus agility is more likely to emerge from a creative process of exploration, and not from mechanistic, prescriptive and commoditized techniques and technologies [9].

**2.2. BPM introduction.** The concept of Business Process Management to extent we understand it today has relatively short history, most of the first serious remarks having around ten years. The definition of this term very much depends on two different perspectives. For more comprehensive historical overview see [2], [1]. On the one hand, from management perspective, BPM is a way to organize a work flow in an organization. It is a dynamic approach where operations of an organization are described by processes. A process is defined as a repeatable sequence of activities, linked to organizational business goals. Execution of the processes contributes to fulfilment of these goals [1]. On the other hand from technical perspective, BPM is an approach to design

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of Enterprise Information Systems and way how to think about system's behavior. BPM prescribe certain architectural model where services are being orchestrated by a Process engine, which perform actual process execution. Software suites for such process design and execution are called Business Process Management Systems (BPMS). The technical perspective is not mandatory for adoption of BPM in an organization in cases where most of the processes are human-centric and Enterprise Information Systems do not play such important role in the organization [5]. BPM as we know today merges those two perspectives into more holistic model, which encompasses strategy, people, business processes and technology [15]. Also practitioners confirm importance of this link is often omitted and lead to inefficient BPM adoptions [19], [5].

**2.3. Recent evolution of BPM.** BPM has roots in its predecessor, Workflow Management. [28] The problems addressed by Workflow Management are covered by BPM as well, but BPM cover the whole process lifecycle, starting with business analysis, through process modeling and execution to monitoring and process optimization. At the very beginning the main focus of BPM was inherited from Workflow Management and it focused predominantly on the technology and process components of BPM, often taking a very mechanistic view of business processes [27], considering primary BPM as technique for process automation. In other words, at the beginning the technical perspective was observed to be more important [27] than the management one. However over time the importance of management perspective grew and today we understand that organizational changes towards the process-oriented principles (today we call it BPM adoption) is crucial for success of any BPM-enabled technical solution [5]. The strong focus on technical perspective of BPM turned to be successful in large projects driven by organization with strong need for automation of bureaucratic processes mostly in banking and insurance industry. These organizations usually had to convert their management structure to some flat model due to their size and naturally had some form of role-based process driven management model. Thus implementing such model into their ICT system did not mean complete change of mindset. A bit different situation is in SME sized enterprises and public organizations of that size. They very often stick with functional hierarchical organizational models and business processes are driven ad-hoc without clear process and role definitions [20], [21].

**2.4. BPM methodologies and methods.** One of serious problems in BPM context is lack of a methodologies and best practices for end-to-end BPM adoption. This problem is confirmed by both practitioners [5] and scientists [19], [10]. They agree especially on deficiency of systematic methodologies guiding through the important early phases of BPM adoption, which involve gathering the information for process modeling, mapping business goals to processes and linking business KPI's to process metrics.

There are existing techniques and methodologies for certain phases of BPM adoption. Despite the fact they do not fit completely for agile approach to BPM adoption, some of them are definitely inspiring and we can leverage some of their principles in agile context as well.

One of the most complete existing methodologies for end-to-end BPM adoption is CBM-BPM-SOMA developed in IBM. It is actually a merge of three separate methods linked to each other. This triplet consists of Component Business Modeling (CBM), which is mainly a technique used for organization assessment and business analysis, originally designed for outsourcing purposes. The second BPM, the core method focused on process analysis. And last, much more technically-oriented Service Oriented Modeling and Architecture (SOMA) technique, mainly focused on efficient identification, definition and composition of services with strong emphasis on service re-usability and governance [6]. This triplet of techniques provides general guidelines for whole BPM adoption cycle, going from business analysis, through process analysis, design of system architecture and ends with implementation of fine grained service oriented solution orchestrated by a BPMS. Nevertheless this methodology is designed for adoption of large scale full featured BPM solution, which includes automation by the usage of one IBM BPM products and the integration of various services and systems. Also for successful use of this methodology it has to be combined with complex knowledge-base of best practices. Several vendors such as Software A.G, Oracle have similar complex methodologies and a set of best practices designed for large solutions, but they keep it carefully a secret. Such solutions fit well complex BPM solutions of large enterprises, similarly CBM-BPM-SOMA and they are not suitable for agile small scale BPM adoptions.

Of course many vendors of BPMSes and related products provide their proprietary techniques and methodologies for gathering BPM requirements and consequent process design, nevertheless those are usually not publicly available and they are tight of characteristics of particular product.

**2.5. Adaptive Case Management overview.** Probably the most significant approach to fostering agility of BPM-like solutions is Adaptive Case Management (ACM). This approach is designed for environ-

ment with high amount of heterogeneous knowledge-intensive work. Adaptive Case Management reached solid amount of publications [7], [8] and became recognized by subjects focused on trends in management and related technologies such as Gartner or Forester [16].

Motivation for ACM has its primary roots in law investigations at U.S. courts, insurance business and healthcare. Such concept was where it was designed for documenting and investigation of criminal cases, insurance claims or patient's treatments [7]. ACM is focused on knowledge workers, who perform knowledge-intensive work, where rigid predefined processes can be observed as an obstacle. Case participants (investigators, clerks or doctors) collect relevant data about particular case from various sources and perform heterogeneous sequences of activities which vary case to case. They choose the order of tasks themselves and create pattern, which can be repeated or extended next time the same or similar case is being processed [7], [8]. These patterns can be recorded and observed as incomplete processes. Such approach can serve as an inspiration for more agile thinking about processes and we can find research focused on definition of such incomplete processes, such as AGLIPO project [11], [13]. Some other researchers go a little bit further and propose techniques for non-intrusive manual process discovery with techniques introduced by social networks [14].

### 3. Main section.

**3.1. Agile process design.** As we mentioned before, one of the key factors of successful BPM adoption especially in SME sized organization is preservation of flexibility. It is crucial to choose a good level of process rigidity. More authoritarian processes definitely set an order in a company and if they are well defined they can lead to good performance. Nevertheless for knowledge workers rigid definition of processes very often mean decrease of productivity [12]. Authoritarian procedures often create obstacles for them. More recent approaches such as Adaptive Case Management can help to challenge this problem [7]. In SME sized organization we have often higher percentage of knowledge workers. More precisely said, the line between a knowledge worker and a routine worker is not as clear as in large-sized organizations. In certain activities of SMEs people often act as knowledge workers, whereas sometimes they do routine work as well. Therefore, thus we cannot simply stick with pure rigid BPM or ACM approach, we have to stay somewhere in the middle. To achieve a good balance between agility and structured processes, we have to keep agility in mind during process definition and modeling phase. We try to define rough process structure and identify sub-processes where we expect different behavior according to particular process instances. Such sub-processes can be easily replaced by their new or ad-hoc versions, or we can create incomplete sub-process without defining its structure [11]. To decide which parts of the process need such specific treatment is not always easy, we have to work closely with process participants to recognize such sub-processes.

**3.2. Alignment of processes to business goals.** One of the crucial conditions for successful BPM adoption is to establish a linkage between organization's goals and processes [19], [13]. Business plan has to be defined in detail and general goals have to be decomposed to measurable objectives, which are mapped to processes inside the organization [27]. Obviously a process that does not contribute to fulfilment of some objective or goal is useless. To be able to map business elements to processes, usually business strategy should be build according to some scheme. Probably the most complete standard in context of Business analysis necessary in early phases of BPM adoption is Business Motivation Model well specified in Business Motivation Model specification [30]. BMM is one of OMG standards family. This standard specification describes a method for identification and proper definition of vision, business goals, objectives and other related entities, which are the necessary input for goal-oriented modeling and process definition.

Once we manage to establish a link between goals and processes, we want to be able to measure how successful we are in our goals and objectives fulfilment by measuring process data [23], [24]. To obtain well measurable processes aligned with our business goals we have to systematically design our processes with business goals in mind. Also metrics we define in process perspective have to be relevant to our business metrics and vice versa. This fact is very often omitted during early stages of BPM adoption process and later when it comes to implementing the business metrics, process developers try to dig anything related to business data from processes. Considering both business and process metrics in early stages of adoption is crucial for successful measurement. This problem was already described by pioneers of process reengineering [18] and remains alive also in modern literature [5].

**3.3. Agile methodology for Collaborative approach to process design.** In this section we will present a subset of our methodology focused on small-scale BPM adoptions. This subset is focused primarily on

collaboration of initial process design and also on further collaborative improvement of processes. We will put emphasis on involvement of process participants, as they play key role in gathering of requirements in initial process design as well as consequent iterations focused on process improvement. Early draft of the methodology was applied in practice so far in two case studies. First case study was performed in commercial environment, SME software company: IT Logica s.r.o [25] focused on Web-Application development. Second case study was performed in ICT department of Masaryk University in Brno and was focused primarily on ICT services provided internally to the University [26]. In both cases agility and need for more iterative approach to process design and need for further process maintenance was identified as a drawback of our methodology, so we did recently several changes towards more iterative agile principles.

**3.4. Planning the BPM Adoption.** Adoption consists of several phases. At the end of each phase results should be reviewed and the plan for forthcoming phases should be detailed. In general estimation of effort for each phase is not easy at the beginning and many details about next phase are uncovered at the end of preceding phase. We should also keep in mind that BPM adoption often means changes in both organizational structure and used ICT technologies. This means that changes should be committed iteratively and all new systems should run in parallel and migration should be very careful. Obvious seems to be usage of conventional project management tools which help project manager to deal with planning complexity and make the plan systematic and understandable.

**3.5. Adoption participants.** BPM adoption should start with identification of participants. Key participants should be chosen very carefully as their contribution can significantly influence the whole adoption. We have to make sure all participants are properly informed about the adoption process, they understand the adoption goals and they should be convinced about potential benefits of adoption process.

We are going to describe following participant roles:

- Sponsor
- Organization's management
- Adoption coordinator
- Process analyst
- EIS designers and developer
- Process participant
- Process maintainer

**3.5.1. Sponsor.** This role usually belongs to organization owner or CEO. A sponsor provides resources for adoption process such as funding and allocates internal human resources. His commitment is absolutely necessary for success of adoption and he has to clearly understand potential benefits, risks and overall impact on organization.

**3.5.2. Organization's management.** Each manager has to be fully familiar at least with impact of adoption on his area of responsibility and also understand the big picture of the adoption. On the side of lower management we face often fear of loss of responsibility and importance. Managers play important role in the adoption and we have to carefully explain all benefits adoption can bring to them and make sure all their fears are dispelled.

**3.5.3. Adoption coordinator.** Usually member of external "BPM team". He usually acts as Project manager of the adoption and he is the core person responsible for entire adoption process. He has to plan the adoption process carefully, execute it and periodically monitor the progress. He should be familiar with organization's business context, cooperate closely with Sponsor and Organization's management. He should be experienced process analyst familiar with issues of process modeling and manage team of process analysts.

**3.5.4. Process analyst.** Usually also member of external "BPM team", responsible for interviewing process participants, modeling and documenting organization's processes. Good communication skills are a must. He has to have strong knowledge of process modeling techniques and he should have at least basic knowledge of organization's business domain as well.

**3.5.5. EIS designers and developer.** Internal or external person responsible for design of EIS in target organization. He should have at least basic knowledge of BPMS technologies if a BPMS is used and understand at least basic BPM concepts. He should be aware of desired impact of adoption on organization's EIS.

**3.5.6. Process participant.** Internal organization's worker performing activities of modeled processes. He usually has a key knowledge about how the process works in details and he should serve as main sources of information about modeled processes. Similarly to organization's managers, participants are often afraid of negative impact of BPM adoption on his work. Thus we have to carefully explain all benefits adoption can bring to him and make sure he is willing to collaborate.

**3.5.7. Process maintainer.** Internal person made responsible for further maintenance and improvement of processes after adoption. He should work closely with adoption coordinator and team of process analysts and learn as much as possible. He should learn how to model and modify processes, synchronies changes between organization's business goals & objectives and processes, how to set measures on processes and transform measured data into KPIs. In short, he should be able to perform those steps periodically after end of initial adoption on his own and further develop the organization's processes.

**3.6. Setting preceding the adoption.** There are several activities, which should be done shortly after kickoff the adoption process.

**3.6.1. Introductory meeting.** There should be a meeting which introduce the plan of adoption and create common understanding across all involved subjects.

Such meeting should be attended at least by:

- Sponsor and part of organization's management directly involved in adoption process
- Adoption coordinator, eventually some process analysts
- As much as possible process participants
- Process maintainer

On such meeting we should present most important facts about the adoption and provide space for discussion. Presentation should cover:

- Basic facts about the adoption, such as purpose, goals and expected outcomes
- Highlight the importance collaboration across all the involved subjects
- Outline the whole adoption plan and rough time schedule
- Brief introduction of process used process modeling technique
- Introduction of used PCE
- Rough structure of process interviews

**3.6.2. PCE setting.** We have to make sure all users of our PCE are able to access it and know how to use it. We should also provide a person supporting PCE users to achieve maximum contribution. There should be some example processes as well as feedbacks, so users can use it as a template.

**3.7. Adoption phases.** Adoption consists of several phases performed in a recommended order. However in some cases the sequence of these phases has to be tailored to the situation. For example when the business goals and objectives of the organization are relatively simple, but the business of the organization itself is built on critical mass of EIS components and ICT services, the analysis of those systems turns to be more important and it can be performed earlier. However this leads to the bottom-up approach to BPM adoption, which is not really in scope of the researched methodology.

We are going to describe following phases:

- Organization assessment phase
- Initial process mapping phase
- Iterative process improvement

**3.7.1. Organization assessment phase.** In this phase we gather context information about organization and its business, collect business related information and use it as an input for process analysis and design. These activities are done by Adoption coordinator by performing interviews with organization's management and root stakeholders.

Roles involved: Sponsor, Organization's management, Organization's management, Adoption coordinator

Phase inputs:

- Previous efforts of organization assessment
- Business plan
- Any documents describing organization structure
- Definitions of metrics and previous business data

- ICT services documentation

Phase activities:

1. Review and refine business plan & vision
2. Review and refine goals and objectives (G&O)
3. Review and specify business metrics and KPIs mapped to objectives
4. Describe in detail organizational structure, including roles and responsibilities
5. Describe business components (organization units)
6. Describe ICT services both consumed and provided internally and externally
7. Create priority list of business activities
8. Create complete list of relevant processes mapped to business activities

We first collect the AS-IS state, discuss it with the management and define initial TO-BE state. Nevertheless TO-BE state should not involve much reengineering at this stage. It can involve:

- Business plan re-engineering
- KPIs and metrics definition and re-engineering
- Estimation of quality and costs of ICT services
- proper mapping of G&O to processes
- clear definition of roles

For more formal description of organization business plan&vision and Goals&Objectives we can use some more formal techniques such as Business Motivation Model [30]. However BMM is quite complex technique and can fit only for organizations with more complex business planning. Phase outputs:

- Refine business plan, vision,
- G&O and related KPI definitions
- Description of organizational structure with subordinations, roles and responsibilities
- Prioritized list of business activities mapped to existing processes

**3.7.2. Initial process mapping phase.** To obtain realistic processes that correspond to reality, the involvement of each process participant to the process definition in “design time” is crucial. Otherwise we can easily end up with idealistic process definitions dreamed by management that have nothing to do with reality. The more intuitive technology we use for sharing the modeled processes with process participants, the more efficient collaboration we achieve.

Phase inputs:

- Prioritized list of business activities mapped to existing processes (from previous phase)
- Any documents describing activities involved in modeled processes
- KPI definitions (from previous phase)

Phase activities:

1. Complete prioritized process list (existing and new) with process owners assigned
2. Interview process participants and define initial processes
3. Create Detailed BPMN 2.0 models of chosen processes and write complementary descriptions
4. Define roles within processes and map them to organization’s roles
5. Identify and refine process metrics linked to KPI’s
6. Set up PCE and publish processes there.

Phase outputs:

- Prepared PCE
- Complete list of prioritized processes with assigned owners and roles
- Initial version of process BPMN 2.0 models and descriptions published in PCE
- Clear definitions of process metrics and mapping to KPI’s
- Initial feedbacks about processes from participants stored in PCE

The main responsibility of good process design of the modeled processes lies on Adoption coordinator. It is generally assumed that the processes should be modeled by Process Analysts who are dedicated to this activity, but they do not usually understand each process in detail. Thus they have to cooperate with process participants who are involved in the activities performed within the process. Initial set of defined processes should be also approved by organization’s management and sponsor of the BPM solution. Steps of the initial process mapping phase are described in Fig. 3.1. Here the adoption coordinator captures the scope of the organization and creates list of processes. Then he models and describes the selected processes and publishes

the draft to the PCE. At this step the process participants and organization’s management should provide rich feedback and comments, they have to identify parts of the process which are faulty, unclear or too general. Such feedback is stored in the PCE. After the predefined period of time, Adoption coordinator collects the provided feedback and closes the initial phase.

BPM adoption collaboration process [Initial phase]

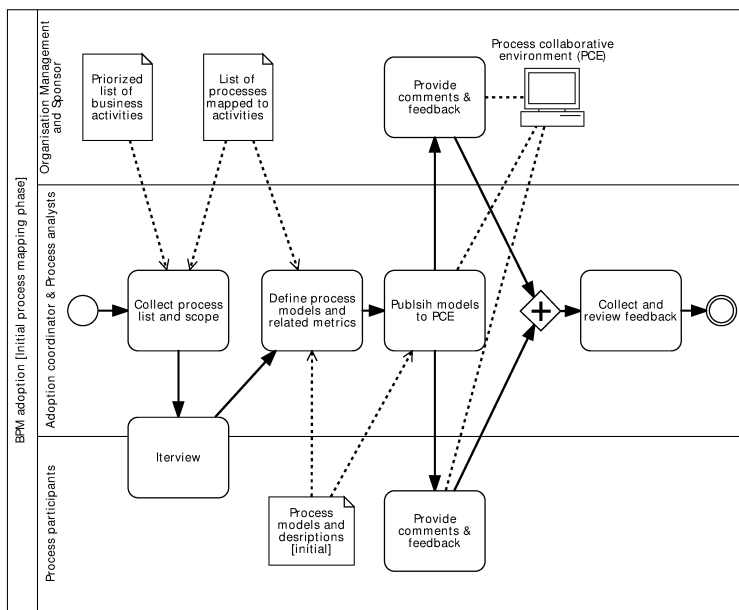


Fig. 3.1: Initial process mapping phase

**3.7.3. Iterative process improvement.** This phase should be performed in short iteration cycles (I would recommend 1-6 months), the anticipated changes should be also of reasonable size, corresponding to the available human resources. Phase inputs:

- Feedbacks about processes from participants and management stored in PCE
- Process update requests (2+ iteration)
- Process data (2+ iteration)

Phase activities:

1. Modify process models and descriptions according to feedbacks and change requirements
2. Discuss changes and get approval with Organization’s management and Sponsor
3. Publish updated processes to PCE and open for discussion
4. Implement changes in processes in EIS
5. Measure process execution automatically or manually
6. Collect process data
7. Let the Organization’s management and Sponsor to evaluate measured data
8. Collect Process update requests from Organization’s management and Sponsor

Phase outputs:

- Modeled and described processes published to PCE
- Updated processes implemented in organization’s EIS
- Process data
- Process update requests for next iteration

The steps of this phase are described in Fig. 3.2. Here the Adoption coordinator initiates first iteration of improvement phase, reviews collected feedbacks and modifies defined process models according to it. Modified models are reviewed by organization’s management and are either approved or disapproved and send back for further modification. In case of approval the solution designer publishes modified version to the PCE and implements the approved processes in EIS. Implementation depends on the agreed level, it can start from simple modification of existing activities in EIS for completing process-engine based implementation in a BPMS. By completing these steps the implementation processes are measured. In case of basic implementation of conventional EIS processes, they have to be measured manually, by collecting events indicating performance of particular activities or even by noting progress per process. In case of automated monitoring tools, data are collected automatically by such tool. After the period of measurement, process data are evaluated by Organization’s management, and process changes are requested for processing to the next iteration.

BPM adoption [Iterative process improvement phase]

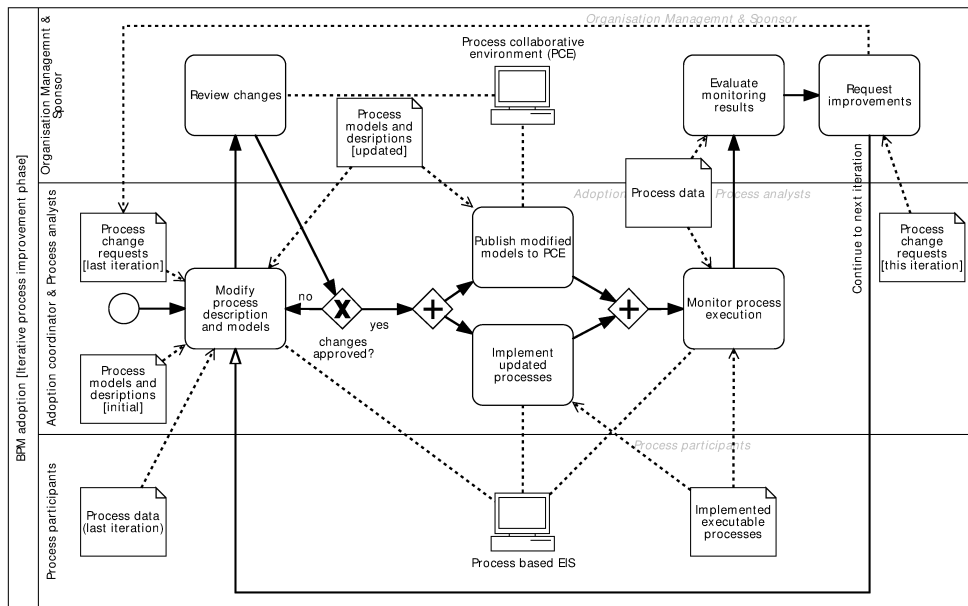


Fig. 3.2: Iterative process improvement phase

#### 4. Future research directions.

**4.1. BPM in Cloud.** With respect to all currently existing cloud-based BPMSes we can say that nowadays purely cloud-based BPMS is still just a dream. Once it comes to choosing reliable BPMS during BPM adoption, we have to stick with existing product-licensed BPMS from traditional vendors. Battle on the field of cloud-enabled BPMS is already started, here the most visible players are current BPMS vendors who try to migrate



their existing products into cloud and provide them in SaaS mode. The main advantages of cloud-enabled BPMS include generally accepted SaaS benefits and several others specific for BPM context.

Probably the more convenient way to leverage cloud technologies is to use BPMS for integrating cloud services relevant to our business. We can leverage such services as email, messaging, document management, web-services, external software components, existing EISes deployed in cloud environment, and integrate them together with locally-hosted BPMS.

Many of today's BPM vendors visible in Gartner's magic quadrant such as IBM, Signavio, Intalio, Pega [17] and others make quite extensive efforts to develop server-side environments for collaborative process design. Nevertheless, most of them allow only local installations on private servers, which get them closer to "private cloud" concept. Public cloud services often rely on open-source technologies. In that sense probably the most popular is Oryx visual editor developed as open source project [31], tailored by some BPMS vendors such as Signavio and Alfresco. However Oryx is a visual modeling tool, and for full blown PCE we need some advanced features such as documentation tool embedded to process modeling in order to ensure collaborative functionalities for participant's feedback and wider collaboration.

There are potential advantages of moving PCE into cloud environment:

- Cloud enables efficient sharing and real-time collaboration
- Cloud enabled PCE is easily accessible from any environment and OS, it does not require any local installations of the dedicated tools
- Centralized storage allows proper versioning, tracking of changes and history

Same as many other technologies and services which are slowly migrated from local-based SW into Cloud, the BPMSes are on their way to cloud as well. However, this is a matter of several years. One of the major reasons is Cloud interconnection. Once you have local-based SW solution which consumes several services from different cloud environments, and you integrate them together, then the situation is quite simple. You just make sure that each of your cloud connectors is working properly. Once you want to migrate the orchestration component into some cloud, the situation is getting more complicated. As long as you consume the services from the same cloud where the orchestration engine is located, you are quite safe because both of them are in "uniform" cloud environment. Problems come when you want to consume services from different cloud providers. The interoperability across different clouds is something not well established, as a matter of fact most of SaaS cloud providers are competitors while the cloud interoperability is not really their business goal.

**5. Conclusion.** We briefly introduced BPM and its history, discussed common issues of BPM adoptions and highlighted the need for agility in context of a BPM adoption. We presented some contemporary research efforts which confirm the need for more systematic approach to adoption of BPM in organization with emphasis on SME sized solutions. Furthermore we reviewed some existing techniques and methodologies for BPM adoption and we outlined part of the methodology for more agile adoption of BPM. At the end we discuss the situation in cloud technologies related to BPM. Our findings show that there are many open questions concerning the problem of increasing agility in the BPM adoption process where cloud technologies can help significantly and simplify the technological perspective of this discipline. Nevertheless the maturity of existing BPM technologies in Cloud environment is low and there is still lots of work to be done towards development of something we call Cloud BPM.

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