Towards an Agile Methodology for Business Process Development

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Abstract. An agile business process development methodology is proposed in this research. An estimation formula is developed in order to assess the efficiency of the new methodology, to yield the required development effort for the traditional case that can be compared to the measured effort with the proposed methodology. Compared with the traditional development of processes, a savings of 27% was achieved. There are currently process development methodologies and limited adaptation work on agile approaches to process redesign. Such existing work do not define a specialized agile methodology for business process development. Existence of many actors renders this field as a complex one where specifying requirements is difficult. Agile approaches may contribute mainly to efficiently gathering desired requirements and may decrease the development time. Also the proposed methodology suggests a critical utilization of training that improves the gathering of quality requirements. Agile requirements gathering, periodic meetings, and incremental and iterative development are observed to be crucial constituents of the proposed methodology during the early studies for applying the methodology to a process in an organization.

Keywords: agile, business process, development methodology.

1 Introduction

A business process is a collection of structured and related steps or activities. Business processes are studied from many different points of view: They are defined, developed, implemented, enacted, configured, and optimized. In other words, management of business processes is required, coining the phrase "Business Process Management" (BPM) [1]. The aim in this article is to propose an agile methodology for developing business processes that is superior to the classical waterfall methodology.

The methodology has been built according to the experiences during the development of business processes using the classical waterfall model. The problems of the classical methodology are identified and an agile approach is proposed to solve them.

Some business processes have been implemented in our organization. They have been implemented through the phases which are analysis, design, and coding. This phased development is actually based on the Waterfall model. During the development it was observed that implementation takes long time and requirements change

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during “going live”. These problems address the need to use agile methodologies with the main expectation of effort saving. The reason is that agile approaches support eliciting better requirements and adapting business processes to the changing conditions.

Some problems occurred in the application of agile methodologies. Business process development is usually more complex than standard software development. Therefore, 2 or 3-week agile iteration durations do not fit business processes. A bit longer periods seem to be more suitable. In addition, a person in the development deals with more than one project at a time where three projects have not been uncommon. Also, daily meetings are time consuming and confusing. Their periods and structure need some arrangements.

The encountered problems demonstrate the need for a specialized development. Since missing requirements can cause reimplementation, gathering of the requirements is very important. Agile approaches should be included to determine the actual requirements of business processes. Also, agile approaches may decrease the development time. In conclusion, applying agile approaches to BPM yielded to develop a specialized agile methodology for business process development.

Related work is presented in the next section. After an introduction to the new methodology, similar work is compared, and application of the methodology is presented. Lastly, conclusions are included.

2 Related Work

A business process is a collection of structured and related steps or activities [10]. There is considerable amount of work on business processes. Surveys on BPM can be found in [1] and [19].

In [11] and [12], a project-oriented development methodology is discussed. The methodology takes an as-is model and tries to optimize it to achieve the to-be model. Another methodology for the business process development relies on web services [13]. In [14] a business process development methodology has been developed that uses UML. Another business process development methodology rests on processes, where they are first class entities [15]. Applications written in BPML [17] will be direct representations of business processes. The work presented in [16] proposes an innovative approach for business process modeling and enactment, which is based on a combination of protocols and policies.

The introduced business process development methodologies are not detailed in the respective papers. Therefore, comparing them was not possible. This situation also addressed that a detailed methodology for business process development is needed.

In recent studies, agile approaches were applied to BPM and social media are used to provide BPM with agility [6] [7] [8] [18]. In all of them, there is a mention of an agile methodology but it is not completely conveyed, except for only a feel of it.

Agile software development methodologies [3] [4] are based on iterative development. Agile methods encourage frequent inspection, adaptation, teamwork, and self-organization to allow for rapid delivery of high-quality software. Scrum [5] is an agile

development methodology whose skeleton consists of iterations and daily inspections. Extreme Programming (XP) [4] [9] is another agile software development methodology which advocates frequent releases in short development cycles where new customer requirements can be adopted.

3 The Methodology

3.1 Definition of the Methodology

This methodology is an iterative and agile methodology. It depends on the process framework where there are some framework activities and some umbrella activities. Process framework is explained in [2]. The framework activities form the stages of the methodology. These stages are analysis, design, construction, going to pilot, going to live, and diagnosis. These stages are shown in Figure 1. Transition between stages is not strict and all the stages can be active at the same time with changing densities according to the progress of the development. This is also shown in the figure. From another perspective a stage actually means a set of tasks in this methodology. Therefore, a stage can be considered as a set of related tasks. In addition to the framework activities, there are umbrella activities which are spread over the entire methodology. In other words, umbrella activities are related to nearly all the framework activities. The umbrella activities are project management and training. Also, keeping history of the development is important.

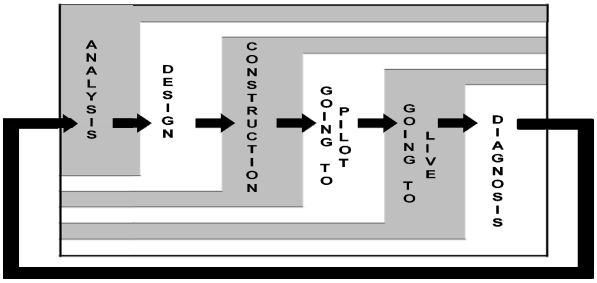

Fig. 1. Stages of the methodology

3.2 Stages of the Methodology

In the analysis stage, requirements are gathered. Use case diagrams are used in this stage. Use cases simply show an actor and its actions. Therefore, working with use cases facilitates determining the roles in a business process.

In order to gather requirements better, site inspection is also included in the analysis stage. Site inspection means examining the business process in its own place. Site inspection also helps to determine the roles of the business process.

It is observed that spike solutions speed up development. Actually they train the stakeholders and support the gathering of better requirements.

In the design stage, process modeling is done using Business Process Diagram (BDP) of Business Process Modeling Notation (BPMN). For fast implementation of the process model, it is assumed that a common screen design is used in all the steps of the process model. Basic input output requirements are determined through this common screen. This screen is referred to as the main input output screen.

In this methodology, any kind of template usage is encouraged because templates can accelerate the development process. In the construction stage, the business process is implemented, verified, and validated. After the pilot stage, live business process starts.

In this methodology, going to pilot is introduced as a stage, because it is observed that pilot application is very important for developing processes. Basically, it provides a preparation for live and increases the success of the implementation. Moreover, the diagnosis stage is also included in this methodology because the diagnosis stage is required in business process management lifecycle [1].

3.3 The Process Model of the Methodology

The process model of the methodology is seen in Figure 2. The model shows the 6 stages of the methodology which are in interaction with the iterations of the methodology. Also, umbrella activities are shown which are spread over the entire methodology.

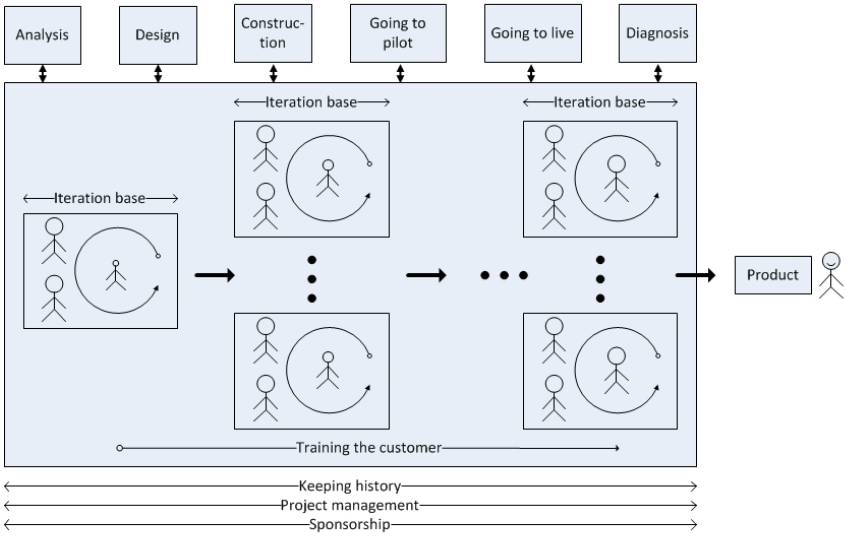

Fig. 2. Process model of the methodology

This methodology requires sponsorship. Usually many organizational units are included in business process development and there are many stakeholders. This increases the complexity of the project and conflicts should be solved by the sponsor when needed.

In this methodology, there are umbrella activities which are light project management, keeping history, and training. Training means training the customer. The more the customer is trained the better the business process is understood. Training is emphasized in this methodology because of the following important reasons:

- Training improves the gathering of quality requirements.
- Training informs people about the process and decrease the development time.
- Training reminds of the decisions taken before, and people do not need to re-solve problems.

3.4 Iteration Base

In this methodology, the 'iteration base' is defined that accounts for incremental development. All the things are done in iteration bases. Figure 3 shows the structure of an iteration base. An iteration base is usually a 5-week period and yields an increment: the process is evolved and something is added to it. In agile methodologies, similar task sets are implemented in approximately in a month. For example, in Extreme Programming a story is implemented in up to a 3-week period [9]. In the Scrum model, a sprint is implemented in 30 days [5]. However, according to the experiences a slightly longer period is more suitable because there are more actors in business processes than in comparable software projects. In short, a period of 5 weeks is chosen for a typical iteration base.

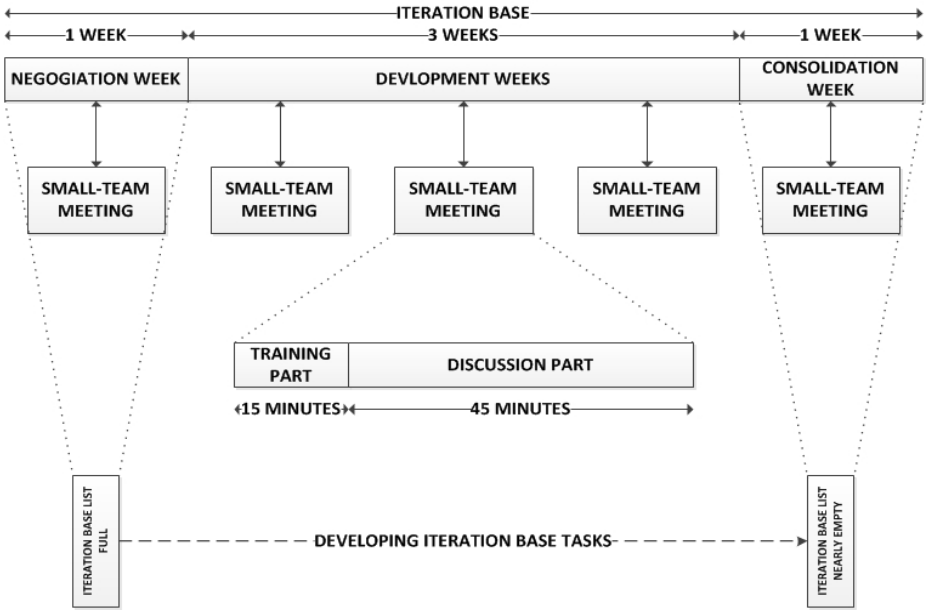

Fig. 3. Structure of an iteration base

A list of requirements is kept like it is done in Scrum [5]. A subset of the list is implemented, which is called an iteration base list, for each iteration base. All the tasks of a project form the project task list. The remaining tasks of the project form the backlog list.

The first week of an iteration base is called the negotiation week. This week of iteration base is used to negotiate with the customer, and prioritize the backlog list and determine the tasks of the iteration base, the iteration base list. The last week of the iteration base is called the consolidation week. In the consolidation week, the iteration base is reviewed and the remaining tasks of the iteration base list are determined and they are added to the backlog list. The intermediate weeks of an iteration base are called development weeks and the tasks of the iteration base list are conducted in these weeks.

An iteration base is usually completed by a small team. Weekly meetings are recommended for small teams. These meetings are called small-team meetings. More than one iteration base can be activated at the same time. Therefore, a person would attend more than one small-team meeting in a week. According to the experiences, more than three meetings in a week are excessive and decrease the development efficiency. For this reason, the project manager should not activate more than three iteration bases related with the same person.

Small-team meetings should be short, i.e., they may take one hour. Small-team meetings are conducted in two parts. The first part is for training and lasts approximately 15 minutes. The remaining is the discussion part.

In the training parts of the meetings, people are informed about the business processes. Especially, the process being developed is introduced to them. If the process has not been developed enough, then the spike solutions of the process can be shown. If neither is available, then other processes can be demonstrated. In the training interval the decisions taken before are repeated also. The aim of this training is to reduce the total development time.

There are also whole-team meetings. Nearly all the stakeholders attend these meetings. These meetings are also structured into training and discussion parts. The whole-team meetings are usually two times longer than small-team meetings. These meetings should be organized when consolidation is needed or when the project needs a refreshment, i.e. drawing attention to the project again.

This methodology is a light weight methodology [21]. Therefore, the documentation requirements should be kept at minimum. However, for each iteration base a simple documentation is good to track the task list of the related iteration base. All the related and required information about an iteration base should be written to this simple document. For the general and required information, again simple but a general document is kept. This document is used to record the interactions and the relations among iteration bases. Moreover, it keeps the history of the development. In other words, every item is added to this document with a date. Therefore, this document glues all the iteration bases in the development.

4 Comparison of Similar Methodologies

The proposed methodology has some similarities with the Rational Unified Process (RUP). First of all, they are both iterative and incremental. Moreover, both of them employ use case diagrams for analysis. However, RUP has strict phases and it is a heavy weight methodology [21]. RUP requires heavy documentation whereas the proposed methodology has light documentation requirements and it is a light weight methodology. In RUP, project management is very important but in the proposed methodology a light project management is included. In RUP, risk mitigation is crucial whereas in the proposed one there is no equivalent.

The proposed methodology is basically an agile methodology. It includes frequent communication, customer involvement, customer satisfaction, short meetings, frequent inspections, product backlog, prioritizing of requirements, cross-functional small teams, self-organization, self-management, self motivation, retrospectives, frequent releases, adaptation, and spike solutions. In addition to these agile approaches, the proposed methodology includes training the customer, keeping history, template usage, main input output screen, site inspection, pilot application stage, and sponsorship.

5 Application of the Proposed Methodology

A new business process has been implemented through the proposed agile methodology and the development effort was recorded. Moreover, nine business processes have been developed using the Waterfall model. Table 1 shows all these implemented business processes.

Table 1. Implemented business processes

Process Name	Applied Methodology	# of Steps(s)	# of Complex Steps(s′)	Effort (person-day)
Consumable Goods Request	Proposed	3	0	34
Purchase Requisition	Waterfall	14	0	130
Insurance Claim	Waterfall	4	0	51
Material Request	Waterfall	5	4	102
Purchase Order	Waterfall	12	0	101
Duty Order	Waterfall	26	0	204
Quality Notification	Waterfall	11	5	156
Quality Tasks	Waterfall	4	2	61
Shipment	Waterfall	3	1	59
Plane Ticket	Waterfall	3	1	52

The implementations are realized in a medium-sized organization. For this study, the guidelines in [20] are used. The main business sector of the organization is electronics. However, these business processes are not related to its business sector. These are general business processes which are related to purchasing, insurance,

material request, duty order, quality control, and shipment. These are implemented usually by two analysts and two developers in cooperation with the customer.

In order to compare the efficiency of the proposed methodology, an effort estimation formula was developed. The formula takes the size of the business process and gives the required effort for it development using the Waterfall methodology. To avoid biasing, a simple formula was chosen. The formula is actually a line equation and it is shown in (1). The parameter "x" is the size of the business process and the constants "a" and "b" was found by linear regression.

$$\text{Effort} = a*x + b \tag{1}$$

The number of steps in a business process is simply the best indicator for the size of the business process. Therefore, the number of steps is taken as an indicator for the size of the business process. Moreover, the complexity of a business process also affects the total effort very much. Hence, the number of complex steps is also taken into account. A step in a business process is considered complex if the step requires user interactions except simple user decisions. The sum of the number of steps and the number of complex steps in a business process is taken as the size of the business process.

Table 1 shows also the number of steps and the number of complex steps in the processes. The last column shows the total implementation effort in person-days. According to the table a simple estimation formula is derived using the least squares approach. The sum of the number of steps and the number of complex steps is taken as an explanatory variable of the simple linear regression (1). The values of Waterfall methodology are used in the least squares estimation. Equation (2) shows the estimated formula where s and s′ correspond to number of simple and complex steps, respectively.

$$\text{Effort} = 7.13*(s+ s') + 26.54 \text{ person-day} \tag{2}$$

According to the formula the new process would be implemented in 47 person days using the classical Waterfall methodology. However, this process is implemented in 34 person days using the proposed methodology. This says that there is an effort saving through the proposed methodology. The proportion of the effort saving is calculated in Equation (3) where approximately a 27% effort saving is demonstrated.

$$\text{Effort Saving:} \quad 1 - 34 / 47 = 0.27 = 27\% \tag{3}$$

6 Conclusion

This agile business process development methodology is defined for business processes and stakeholders dealing with more than one project concurrently. It is iterative and incremental. Customer involvement is realized and new requirements are gathered in short development cycles called iteration bases. The project task list is prioritized frequently to queue up the most valuable requirements for iteration bases.

While spike solutions increase the communication between the stakeholders, small teams ensure frequent communications through periodic meetings.

In this agile business process development methodology, sponsorship, lightweight project management, use case diagrams, site inspection, BPD diagrams, template usage, and main input output screen were employed. This specialized methodology gives great emphasis on training, keeping history, going to pilot stage, and determining the roles. Especially training is important because it creates awareness about business processes so that it supports the success of the development.

A formula is derived for estimating the effort required in the development of a business process based on the traditional approaches. The actual effort used in the development of a new business process is compared to the estimated effort if it was developed using the traditional approach. The proposed method showed a 27% effort saving.

References

1. van der Aalst, W.M.P., ter Hofstede, A.H.M., Weske, M.: Business Process Management: A Survey. In: BPM 2003. LNCS, vol. 2678, pp. 1–12. Springer, Heidelberg (2003)
2. Pressman, R.: Software Engineering A Practitioner's Approach, 6th edn. McGraw Hill, New York (2005)
3. Agile Manifesto, http://agilemanifesto.org/principles.html (accessed January 12, 2012)
4. Lindstrom, L., Jeffries, R.: Extreme Programming and Agile Software Development Methodologies. Information Systems Management, 41–52 (2004) (summer)
5. Schwaber, K.: Agile Project Management with Scrum. Microsoft Press, Washington (2004)
6. Larson, S.: Applying Agile Software Development Methodologies to Business Process Redesign/Management (BPRM). In: Proceedings of the Southern Association for Information Systems Conference, Atlanta, GA, USA, March 26-27 (2010)
7. Silva, A.R., Meziani, R., Magalhães, R., Martinho, D., Aguiar, A., Flores, N.: AGILIPO: Embedding Social Software Features into Business Process Tools. In: Rinderle-Ma, S., Sadiq, S., Leymann, F. (eds.) BPM 2009. LNBIP, vol. 43, pp. 219–230. Springer, Heidelberg (2010)
8. Bruno, G., et al.: Key Challenges for Enabling Agile BPM with Social Software. Journal of Software Maintenance and Evolution: Research and Practice 23, 297–326 (2011)
9. Extreme Programming, http://www.extremeprogramming.org/ (accessed January 18, 2012)
10. van der Aalst, W.M.P.: Three Good Reasons for Using a Petri-net-based Workflow Management System. In: IPIC 1996, Cambridge, Massachusetts, pp. 179–201 (November 1996)
11. Weske, M., Goesmann, T., Holten, R., Striemer, R.: Analysing, Modelling and Improving Workflow Application Development Processes. Software Process: Improvement and Practice 6(1), 35–46 (2001)
12. Weske, M.: Business Process Management Concepts, Languages, Architectures, doi:10.1007/978-3-540-73522-9_8
13. Papazoglou, M.P., van den Heuvel, W.: Business Process Development Life Cycle Methodology. Communications of the ACM 50(10) (October 2007)

14. Yamamoto, R., Yamamoto, K., Ohashi, K., Inomata, J.: Development of a Business Process Modeling Methodology and a Tool for Sharing Business Processes. In: Proceedings of the 12th Asia-Pacific Software Engineering Conference (APSEC 2005). IEEE (2005), doi:0-7695-2465-6/05
15. Smith, H.: Business Process Management—the Third Wave: Business Process Modelling Language (BPML) and its pi-calculus Foundations. Information and Software Technology 45(15), 1065–1069 (2003)
16. Desai, N., Mallya, A.U., Chopra, A.K., Singh, M.P.: Processes = Protocols + Policies: A Methodology for Business Process Development (2004). In: Proceedings of the 14th International World Wide Web Conference, WWW 2005 (2005)
17. Arkin, A., et al.: Business Process Modeling Language (BPML), Version 1.0 (2002)
18. Schatten, A., Schiefer, J.: Agile Business Process Management with Sense and Respond. In: IEEE International Conference on e-Business Engineering (ICEBE 2007), pp. 319–322 (2007)
19. Møller, C., Maack, C.J., Tan, R.D.: What is Business Process Management: A Two Stage Literature Review of an Emerging Field. In: Research and Practical Issues of Enterprise Information Systems II. IFIP International Federation for Information Processing, vol. 254, 1, pp. 19–31 (2007)
20. Runeson, P., Höst, M.: Guidelines for conducting and reporting case study research in software engineering. Empirical Software Engineering 14(2), 131–164 (2009)
21. Khan, A.I., Qurashi, R.J., Khan, U.A.: A Comprehensive Study of Commonly Practiced Heavy and Light Weight Software Methodologies. IJCSI International Journal of Computer Science Issues 8(4(2)), 1694–814 (July 2011), http://www.IJCSI.org