Survey of Practitioners' Attitudes to Software Process Modeling

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Abstract

Software process modeling has evolved fast during the past few years. New dedicated modeling standards and process-based tools have been introduced. Emerging trends of the process modeling could bring even more radical changes. These changes have affected the work of common software industry practitioners. Results of a qualitative survey, which was conducted amongst Finnish software practitioners, are presented in this paper. The goal of the survey was to map the attitudes of the practitioners towards the use of software methodologies and software process modeling in their own work. In addition the practitioners provide expert analysis on the emerging modeling trends. The answers of the practitioners are analyzed in this paper and conclusions are given on how the practitioners see the current state and the near future of the software process modeling.

Keywords

Software Process Modeling

Introduction

Software process modeling and software process models are essential techniques in making understandable process descriptions. Efficient modeling and clear, up-to-date process models are essential part of many software process improvement (SPI) activities. Several different techniques have been used to construct the models: Work-flow diagrams, more advanced business process modeling languages, and also dedicated software process modeling languages. Development in the field of software process modeling has enabled new applications for the models and brought the models closer to the every-day project work in the software industry.

Many practical applications of the process modeling require strong tool support. For example a simple task like keeping a process model up to date can become laborious with basic office tools. Existing modeling language standards simplify and in many cases enable the implementation of modeling tools. Modeling languages standards are also essential for model reuse and model interchange between different organizations. There has been swift development in both modeling standards and tool support during the past five years. This development has increased the software industry's interest towards the software process modeling.

Second version of the Software Process Engineering Metamodel (SPEM) modeling language standard [1] was released in 2007. The SPEM modeling language has provided a foundation for development of new generation of software process modeling tools. IBM has constantly published improved versions of its Rational Method Composer (RMC) [2] modeling tool which is indirectly based on the SPEM standard. Partly based on the RMC code, almost identical tool is freely available through the Eclipse Process Framework (EPF) project [3]. The EPF project also distributes models of several popular process methodologies. Latest advancement is the IBM's Team Concert tool [4] which uses simple process models as a mean to configure the project tools (e.g. user rights, version tracking rules and communication). Microsoft has also same kind of ideas in their Visual Team System product [5].

This paper reports the results of a qualitative survey of software practitioners' attitudes on software process modeling. There were three goals for the survey. First goal was to get objective information about the current state of the process modeling in the software industry. This was done by obtaining information about practitioners' personal attitudes towards process modeling and also about the underlying work methodologies. Second goal was to get expert analyses on the upcoming trends of the process modeling. Third goal was to evaluate the research team's own beliefs of the process modeling which were based on the literature and the team's own experiences.

The research was conducted as a two-part qualitative survey. In the first part the respondents answered the web-based questionnaire at their own pace. The questionnaire included mainly open questions grouped in three categories: 1) Influence of work processes in respondents' own work, 2) influence of process models in respondents' own work, and 3) analysis on the upcoming trends of process modeling. In the second part of the survey the answers of the selected respondents were supplemented during personal interviews. The interviews were done after the preliminary analysis of the answers of the first part questionnaire.

The survey results were analyzed by our research team. The team consisted of both university researchers and industry practitioners. The idea was to use a scientific method to get relevant results, which would also serve industrial needs. During the analysis the research team tried to find common elements and also contradictions in the answers to form meaningful conclusions. In addition to the qualitative analysis, the team used straightforward quantitative methods to analyze the respondents' answers to certain, individual questions. It should be noted that the percentage values presented in this paper can not be directly generalized outside this study.

The structure of the paper is following. In Section 0 the respondents' opinions on the impact of the software methodologies, processes and models to their every-day work are presented. In Section 0 respondents' views on the selected software process modeling trends and the future of the software process modeling are analyzed. Section 0 presents the research team's plans on continuing and extending the research of practitioners' opinions on the software process modeling. Finally in Section 0 the paper is concluded.

Current State of Modeling

The questionnaire was send to several software companies from the research team's partner network in Finland during spring 2009. Twenty practitioners (N=20) from fifteen different companies participated the survey. The total number of people who actually received the invitation to the survey is hard to determine, but about one fourth of those who opened the survey web page actually filled the survey.

Respondents' company sizes varied quite evenly from micro companies to large companies. The roles of the survey respondents varied from developer and project manager to process engineer and company executives. When the more detailed work descriptions of the respondents were analyzed there was usual variation between the work descriptions. No particular sector of the ICT industry was overemphasized. Most of the respondents worked in the various software development projects, but there were also respondents working in e.g. ERP system development, methodology engineering and maintenance projects. The exact distributions of company sizes and respondent work roles are presented in Table 1.

Company Size	Respondents
1-9 employees	10 %
10-99 employees	10 %
100-499 employees	30 %
500-3000 employees	35 %
over 3000 employees	15 %

Role	Respondents
Project worker	40 %
Project manager	30 %
Process engineer	20 %
Business management	10 %

Table 1 Company sizes and roles of the respondents

The respondents were inquired about the methodologies and process frameworks their employees had implemented. This was done to better understand the use of process modeling and modeling needs in respondents' everyday work. Based on the detailed answers, it can be said that most of the respondents were quite well aware of the methodologies used in their companies and the maturity of the used methodologies.

It was found out that 85 % of the respondents recognized at least one methodology to be used in their company. The methodologies used in the respondents' companies varied and there was not one clearly dominant methodology. For example ISO standards, ITIL, RUP or variant, CMM(I) and Agile methodologies were mentioned by multiple respondents. Half of the companies used more than one methodology. Usually a standard methodology was accompanied by company's own process methodology or guidelines. The maturity of the used methodologies also varied: 40 % of the companies had used a methodology for several years and 40 % were at the beginning of the methodology adoption. It could be seen from the answers that almost all of the companies were constantly developing their processes and evaluating underlying methodologies.

The information presented above is mainly background information. The respondents' views on the benefits and drawbacks of the methodologies and process modeling are analyzed next.

By analyzing the overall attitudes of respondents it can be concluded that 65 % of the respondents found the process frameworks beneficial for their work, 15 % had negative experiences, and 20 % had neutral attitude. Negative experiences seemed to be result of poorly defined or too inflexible processes. Although many respondents had positive overall experience, most of them also found some negative aspects in the use of the methodologies. In addition many respondents emphasized that the use of the guidelines and the methodologies has to be adapted case by case in order to get the most out of them.

More detailed analysis of attitudes revealed that the many respondents saw the methodologies as a kind of foundation for either the development work itself or the improvement activities. Many of them also said that methodologies enable reuse of practices which in turn saves time in different phases of project work. On the other hand the reuse could lead to repeating old mistakes. Other more negative attributes connected to the methodologies were inflexibility and unnecessary overhead caused by a methodology.

Although only 20 % of the respondents worked mainly with methodology improvement issues, almost

all respondents had participated in the process improvement activities: 55 % directly, 35 % indirectly e.g. by giving feedback about the process, and 10 % had not participated at all.

The use of the software process modeling was investigated by a set of yes / no claims about the state of the process descriptions and modeling in the respondents' companies. The answers are collected in Table 2. It can be said that while the use of standard methodologies was unexpectedly high in the respondents' companies the use of process modeling seemed to be more normative. The table shows that the advanced process modeling techniques like dedicated modeling tools, formal process models and use of modern process modeling language were still rare in the companies. It is also notable finding that number of the *"unknown"* answers increased when more technical issues were inquired.

Claim	Yes	No	Unknown
Implicit documentation	85 %	10 %	5 %
Several fragmented documents	65 %	25 %	10 %
Centralized documentation	45 %	55 %	0 %
Hypertext-based documentation	55 %	35 %	10 %
Dedicated process documentation tool	20 %	65 %	15 %
Processes described mainly as natural language	60 %	30 %	10 %
Processes described as natural language and models	50 %	30 %	20 %
Processes described as formal process models	15 %	65 %	20 %
Formal models done with drawing tools	50 %	25 %	25 %
Formal models done with process modeling tools	25 %	50 %	25 %
Modeling done with self-made language	10 %	65 %	25 %
Modeling done with work-flow diagrams	55 %	25 %	20 %
Modeling done with dedicated language	20 %	60 %	20 %

Table 2 How the work processes are documented in respondents' companies

The process modeling tools and languages the respondents use in their work was also inquired. 35 % of the respondents used dedicated process modeling tools, 25 % used some other tools like drawing software while 40 % did not use any process modeling tool or language. SPEM was mostly used modeling language while Business Process Modeling Notation (BPMN) and Universal Modeling Language (UML) were also in use.

The concrete use of the process models revealed that about half of the respondents used models just to access common document templates or checklist. Only one fourth of respondents mentioned process models as a tool for process tailoring and software process improvement. The question about the use of process models also showed that many people used the word *"model"* as a synonym for the word *"methodology"*. This was confusing because the research team used the word *"model"* to represent a result of modeling efforts.

The respondents would develop the use of the process models and modeling in their company in various ways. Only 75 % of all respondents actually answered to the model development question. All of them saw improvement possibilities and were able to specify clear development suggestions. Many respondents mentioned that the modeling tools should be improved and the use of dedicated modeling language increased. One respondent noted that this could take longer than expected: *"Formal modeling is our next step but this step is bigger than we first thought"*.

Some respondents wanted to increase flexibility of the models. One rationale behind this was to enable tailoring of the models for different situations. There were also suggestions about making a library of more detailed process models for different small scale situations. This approach resembles the emerging practice-based process modeling [6] [7] which is probably still quite unknown amongst the practitioners. Rest of the respondents wanted to increase the use of models by making them clearer, easier to read, and more comprehensive. Also training for using the models was needed.

Answers about the process modeling seemed to suggest that the maturity of the software process modeling was lower than the maturity of software methodologies which were used in companies. 85 % of the respondents knew that their company utilizes at least one development methodology but only 60 % used some kind of modeling tool. It also seems that the respondents were more familiar with methodologies and their use than meaning and the use of the software process modeling.

Emerging Trends

The second goal of the survey was to get practitioners' analysis on the vitality of emerging software process modeling trends. Three most interesting modeling trends were selected based on the research team's previous research [8] and the recent advancements in the modeling techniques. The trends that were presented to the respondents were:

- **Distributed process modeling.** Distributed process modeling is an approach which emphasizes bottom-up modeling practices. Portions of the process models are done in the projects where the process is used. This approach is opposite to the top-down, process engineer led process modeling. In practice, both aspects have to be taken into consideration. Techniques for distributed process modeling are proposed e.g. in the paper [9].
- **Light-weight process modeling.** Light-weight process modeling means focusing only on the most important elements during the process modeling. Idea is to quickly form a starting point for longer modeling efforts or to quickly illustrate the current state of the process. The approach is opposite to the traditional business modeling techniques where target is to generate very accurate models. Techniques for light-weight process modeling are described in the papers [10] [11].
- **Decrease of project-process-gap.** There's always overhead when process description and methodologies are enacted into an actual project organization. The gap can lead to process deviations and make measuring the project difficult. The gap can be decreased with modern process modeling techniques for example by configuring the project tools using the actual process descriptions. Ivar Jacobson has discussed about the project-process gap and developed a practice-based method to deal with the issue [6]. Process modeling techniques for reducing the gap are presented e.g. in the paper [12].

The respondents were asked to evaluate whether the techniques described in the trends would be applicable to their own work and if they would benefit from these trends. They were also inquired to analyze if some of the techniques were already applied in their companies.

Surprisingly many of the respondents had hands-on experiences on *the distributed process modeling*: 30 % of them had at least tested the principles related to this trend. Half of the respondents had positive attitudes towards this trend while others were neutral about the trend. The respondents liked the idea that the process users can directly affect the process models. They also saw that it is efficient to define process where it is used. This way there would be less process deviations in the project level and the overall process model would better resemble the reality.

The respondents found also many possible pitfalls in the distributed process modeling. The largest concern was the integration of the distributed models into one company-wide model. Many respondents mentioned that strict distributed modeling would not work, but traditional top-down techniques would still be needed to accompany the distributed modeling. There were worries about extra workload and insufficient skill levels of the project workers who would have to participate more actively in process modeling. As a solution the respondents offered a modeling facilitator who would do the actual modeling in co-operation with the project team, and take care of the integration and other technical issues.

The light-weight process modeling was a little bit more unfamiliar concept: Only two of the respondents had tried the techniques related to this trend. Controversially to the previous trend even 70 % of the respondents had positive attitudes towards this trend. The respondents liked the idea to model only necessary elements and reduce unnecessary overhead. The trend was connected to the principles of agile methods by several respondents. Iterative process development was also mentioned.

The largest problem with light-weight modeling was how to identify the most important process elements and define the detail level of the modeling. Solutions for this problem were not found. Some respondents also identified that the light-weight process modeling has very focused applicability: It works best for sketching and piloting new methodological ideas, and for forming a starting point for longer lasting process modeling efforts.

The decrease of the project-process gap with process modeling techniques was clearly the most abstract concept for the respondents. Although 65 % of the respondents had positive attitudes towards

this trend, the analysis was not as detailed as with the previous trends. The main message was that it is hard to see how the project-process gap is actually decreased because the tools and modeling standards do not yet fully support this approach.

The survey was concluded with the question about the respondents' own opinions on the future trends of the software process modeling. Almost all respondents saw that meaning of the process modeling and process methodologies will generally increase in the near future. The respondents emphasized the importance of the development of the both process and project tools, and their interoperability. It seemed that there are methodologies, modeling languages and tools available already but their maturity is still quite low. Full potential of the modeling technologies is still to be reclaimed. Optimistically, the respondents believed that this will eventually happen.

Further Work

As mentioned before, this was a qualitative survey and therefore percentages presented in the paper give only hints on which issues were more important and which were less important for the respondents as a whole. Because of the small sample (N=20) the percentage values themselves are not statistically significant.

This study acts as a starting point for a longer research on the practitioners' attitudes and expectations towards the software process modeling. The qualitative analysis presented in the paper was a necessary step to form understanding of the modeling issues that are important for the practitioners. Next the research team is planning to conduct a statistical survey that will provide more comprehensive information on tighter formulated set of hypotheses.

In the study presented in the paper the population and the sample was limited to the Finnish software practitioners. Therefore conclusions can be drawn only about Finnish software industry. In the following study the survey will be conducted in several other countries as well. There might be regional differences on the attitudes since the software methodology culture seems to vary geographically. In the following study the research team expects to deepen understanding on the differences of the attitudes of different employee groups by using more formal statistical analysis.

It will also be interesting to follow how the field of the software process modeling will evolve in the near future. As the study continues the research team will observe how well the expert analyses of the respondents realize.

Conclusions

There should not be big surprises in the overall results of the survey for those who have followed the recent development of the software process modeling concepts, methods, languages, and tools. Practitioners welcome, with healthy criticality, new methodologies that will improve their ability to do their every-day work better. Naturally the methodological frameworks do not offer a silver bullet, but some kind of structures and guidelines are clearly needed in the software work.

The software process modeling concepts seem to be still a little bit unfamiliar for the practitioners, although the project and development methodologies are quite well known. Reason for this might be the immaturity of the modeling languages and the tools. It should also be noted that only portion of the practitioners actually modify the process models, and therefore work directly with the modeling tools and languages. For others it is sufficient to understand the models and maybe give constructive feedback about them. This situation might however be changing because of the trends presented in this paper.

The unity of the practitioners' answers for the survey was interesting. Despite the fact that the respondents represented many different work roles and different-sized companies, they all looked quite positively at the methodological issues and changes in the process modeling field. Maybe the people who are interested in these kinds of issues became selected as the respondents and this somehow biased the results. However, it can be said that there are people in the software industry who are

open-mindedly willing to adopt new methodologies, but at the same time they expect to see direct improvements in their work environment.

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