Improving Diffusion Practices in a Software Organization

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Abstract

Methods and tools that support systems development (SD) are usually motivated by a promise of better quality or increased productivity. In large software organizations specialised methods departments often manage these methods and tools. However, these methods departments often focus more on purchase, tailoring and maintenance of technologies rather than on systematically diffusing methods and tools into current practices. This paper reports from a systematic improvement initiative in a large software organization. The aim of this effort was to diagnose diffusion practices, evaluate and adapt a service that can improve diffusion practices, and to diffuse this new service. Insights from this initiative together with theoretical reflections on diffusion of SD technologies are provided. It is suggested that provision of services that help projects understand and plan diffusion of new SD technologies can play a key role in developing the focus and competencies needed to improve diffusion practices in large software organizations.

1. Introduction

Software organizations face a constant challenge to adopt new technologies. The emphasis on new system development (SD) technologies is usually motivated by expectations such as improved software quality or increased productivity. However, these expectations are often not fulfilled [1]. Successful diffusion of SD technologies requires that people change their working habits, and this is by no means a simple task [2].

In this paper, we report from a long-term Research and Development (R&D) project focused on improving diffusion practices at Volvo Information Technology (Volvo IT), a large, Swedish software organization. Volvo IT has approximately 4,300 employees worldwide. One thousand of these employees are involved in systems development and maintenance. Volvo IT, as many large software organizations, has a methods department responsible for managing and diffusing SD technologies such as methods, tools, and techniques. Our research has focused on Volvo IT’s methods department, called “Common Skills and Methods” (CSM), and in particular on the diffusion practices of CSM.

An attempt to improve such complex organizational processes as diffusion of new SD technologies requires a systematic approach. One such systematic approach to Software Process Improvement (SPI) is the IDEAL model. The R&D project at Volvo IT was organized according to the IDEAL model, which divides an improvement effort into five phases: Initiating, Diagnosing, Establishing, Acting and, Learning. IDEAL provides organizational improvement efforts with a roadmap for initiating, planning, and implementing improvement actions [3]. The IDEAL model is shown in figure 1.

The diagnosis phase of the R&D project was performed during the autumn of 1999 and it focused on diagnosing current diffusion practices at CSM. This diagnosis showed that there were significant problems with current diffusion practices, such as lack of clear prioritization between various efforts from top management; no identification of stakeholders or possible conflicting interests between stakeholders; absence of direct interaction with involved actors and stakeholders; no conscious choice of implementation strategy; and no follow-up of previous diffusion efforts [4].
During the establishing phase, an alternative approach to diffusion of SD technologies was established based on the findings from the diagnosis and experiences from a similar SPI project at Danske Bank. The key idea in this approach was that diffusion project members should engage in discussions concerning important aspects of a diffusion effort. The discussions were organized as a workshop, based on a diffusion workshop concept developed at Danske Bank [5].

In the acting phase, initiated in spring 2000, the diffusion workshop was adopted to suit the needs of CSM and six pilot projects tried out the workshop between autumn 2000 and spring 2001.

In the learning phase the refinements implemented during the tryout period and the pilot projects were analyzed and compared with the projects diagnosed in 1999. The new approach to diffuse SD technologies has been applied recursively to itself to develop a scheme for institutionalizing the new service as an integrated part of CSM practices.

The focus in this paper is on evaluation and adaptation of a service that would increase project members knowledge about diffusion issues and help them plan and execute their diffusion. In the following section we describe the research and improvement approach in greater detail. The diffusion approach is described in the next section. We then present our practical attempts at changing the diffusion practices of the method department at Volvo IT. Subsequently we evaluate the diffusion approach and discuss our findings.

2. Research and improvement approach

The paper is based on an ongoing action research effort at Volvo IT in Göteborg, Sweden in collaboration with the Viktoria Institute, Göteborg. The purpose of this research effort is to improve the practice of diffusing SD technologies at Volvo IT and to learn about ways to turn insights from diffusion of information technologies in general and SD technologies in particular into practical action.

2.1. Research Approach

Our research is based on an extensive case study at Volvo IT and the major findings are hence related to the specific circumstances and traditions of this particular software organization [6]. The major contribution of the paper is the experiences from Volvo IT and the theoretical interpretations made of these experiences. It is advisable to adapt the insights and suggestions from the paper before applying them to other large software organizations.

Our overall approach is collaborative action research [7]. This approach implies a close collaboration between practitioners and researchers, where the research addresses problems and challenges involved in software practices in a specific organization. The paper presents results from an evaluation of a systematic approach to diffusion of SD technologies. A mixture of action research, practice studies, and field experiment were used to evaluate current diffusion practices and to develop alternative approaches.

A number of diffusion projects were diagnosed before the diffusion workshop was adopted and tried out in practice and the original diagnosis was used as a reference for evaluating the experiences with the new approach. The pre diffusion workshop projects were evaluated using open-ended interviews [8] in combination with diagnostic maps [9].

The adoption of the diffusion workshop was documented using diaries [10], open-ended interviews [8] combined with diagnostic maps [9], and systematic evaluations of each trial effort.

Three out of six diffusion workshops were recorded. After each workshop the participants were encouraged to provide spontaneous and informal feedback. 3 to 6 months after each diffusion workshop an interview was conducted with both a project member and a person in the target organization. The interviews were performed separately and lasted up to one hour.

Finally, a detailed scheme for institutionalizing the workshop is currently being developed and implemented, based on the results from using the diffusion workshop on itself.

2.2. Improvement Approach

The R&D project conducted at Volvo IT can, in more practical terms, be seen as an application of the IDEAL model to improve diffusion practices at CSM.

During the initiation phase, of the R&D project, collaboration was set up between researchers from the Viktoria Institute and practitioners from CSM. There were
several indications suggesting that diffusion efforts conducted by CSM had been less successful than expected. Thus a diagnosis project was initiated in order to find out more about the current state of diffusion practices at CSM.

In the diagnosing phase four case studies of diffusion efforts within CSM showed a number of problems [4]. The experiences with diffusion improvement that Danske Bank shared with us together with the findings from our diagnosis formed the base for adopting an alternative diffusion approach. This improvement approach was based on a diffusion workshop concept developed at Danske Bank [5].

The original diffusion workshop was adapted to suit the specific needs of Volvo IT and CSM during the establishing phase. Major shortcomings identified in the diagnosis that resulted in changes in the original diffusion workshop involved: additional focus on stakeholder analysis; identification of a success criteria for the diffusion effort; and modified diffusion risks analysis.

The modified diffusion workshop was evaluated and modified through field experiments, involving six pilot projects. CSM managed all pilot projects and they were all eventually aiming at diffusing some sort of new SD technology.

Each of the pilot projects provided additional insights that were analyzed and used in the acting phase to further refine and adapt the diffusion workshop.

The diffusion workshop is now established as a service and the next step is to educate personnel within CSM, establish a maintenance organization, and to diffuse the diffusion workshop into the organization. The diffusion workshop itself was used to structure and plan the project that evaluated and later will diffuse the diffusion workshop. This resulted in a strategy in which pilots are used during the evaluation and a stepwise approach is used during the diffusion.

### 3. The Diffusion Approach

The 1999 diagnosis uncovered significant problems with CSM’s present diffusion practices, as mentioned in section 1. Moreover CSM had a history of diffusion efforts ending with reports or guidelines that no one would read. Thus a new diffusion approach could not just result in another report being handed out. The idea of providing a service requiring direct interaction, rather than a set of guidelines, seemed like an interesting approach.

The diffusion workshop service required that project members participated in the workshop event and it required them to engage in the various exercises. These exercises, depicted in figure 2, were forcing project members to openly discuss and make consensus decisions on a number of important diffusion issues. The first exercises require project members to discuss the scope of their diffusion effort and to decide on some measures on diffusion success for their project. The second exercise emphasise the most important roles during a diffusion effort. The project members need to identify persons for each of these roles, unoccupied roles require the project to take action. Next the “whole product” concept is explored, identifying add-on services required to provide a more usable product [11]. Pros and cons with various implementation strategies and change models are described and the project members discuss which approach would be most suitable for their diffusion effort. A risk analysis is then performed with focus on diffusion risks. All of these exercises span activities that need to be executed and these activities are organised in a rough implementation plan at the end of the workshop.

**Figure 2. The diffusion workshop exercises**

The workshop requires two facilitators, one documenting the exercises and one guiding the exercises. The main ideas in the workshop are:

- Create a common understanding about the specific project diffusion goals and problems amongst all members in the project.
- Identify and appoint important diffusion roles.
- Focus on developing whole-products with complementing services tied to the actual product [11].
- Assist project members in making a conscious decision regarding which combination of diffusion strategies [12] and change models [2] to use.
- Identify project specific diffusion risks and prioritise amongst these and an additional set of common diffusion risks.
- Put together identified activities into an implementation plan.

An evaluation of the diffusion workshop developed at Danske Bank was performed and necessary adaptations to meet Volvo IT specific requirements were carried out as part of the R&D project.
4. Insights from Experiments

The six pilot projects presented below participated in a case study conducted during the evaluation of the diffusion workshop concept. Directly after each diffusion workshop the participants were asked about the pros and cons with the workshop. Later on open-ended, one-hour interviews were held with a project member from each project. They were interviewed separately and the intention was to find out their perception of the diffusion workshop impact on the implementation of their project.

In Table 1, each workshop exercise is valued in terms of its contribution to each pilot project. Values 1-5 are used, where 1 represents a low contribution and 5 a high contribution.

Table 1. Contribution of exercises to projects

<table>
<thead>
<tr>
<th>Workshop exercises</th>
<th>Satellites</th>
<th>Kamikaze Pilots</th>
<th>Professionals</th>
<th>Hypotheticals</th>
<th>Ostriches</th>
<th>Entrepreneurs</th>
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<tbody>
<tr>
<td>Scope</td>
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<td>4</td>
<td>5</td>
<td>3</td>
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<td>Whole product</td>
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<td>5</td>
<td>2</td>
<td>5</td>
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<td>Impl. Strategy</td>
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<td>2</td>
<td>2</td>
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<tr>
<td>Risks analysis</td>
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<td>5</td>
<td>3</td>
<td>2</td>
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<td>5</td>
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<tr>
<td>Impl. plan</td>
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<td>5</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>5</td>
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<tr>
<td>Duration</td>
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<td>3.75h</td>
<td>4h</td>
<td>3.5h</td>
<td>4h</td>
<td>5h</td>
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4.1. The Satellites

The satellites project was a project for creating methods and guidelines for a new system architecture based on new technology. The participants were members from different departments and were all experts on their own special area. The workshop was made in a very early stage of the project. The fact that each member was an expert on his/her area made him or her a satellite, far away from each other’s view. The workshop had many participants, about 17; it lasted for 4 hours and contained a lot of long discussions. The hottest issue was to set the scope of the project, many opinions were ventilated and many facts came up that most of the members did not know. Discussions came also up about interpretation of words, e.g. what is a pilot run.

The immediate reactions from the workshop participants were that it was well worth the half day. It gave them a common view of the projects tasks and goals, it was good that everybody in the project was present, participating in the workshop; good that it was documented by the facilitators; impressive to get a rough implementation plan right away; and, that the workshop was made at the right phase of the project. Improvements could be done in the section of the workshop going through the strategy and change models, they needed more information and examples of what are the consequences of choosing one or another. In addition, on the minus side was the fact that after 4 hours you are tired and hungry; they needed badly a lunch break.

At the later interviews it turned out that the scope constantly changed throughout the project and that the implementation plan was decimated to activities of creating, gathering and spreading documentation to the involved actors. Still, they believed that the workshop gave them a good baseline for scope and purpose of discussions.

The key lessons:
- Even 17 satellites can agree on the same scope after a diffusion workshop.
- A loosely defined project cannot have a clear implementation plan.

4.2. The Kamikaze Pilots

The Kamikaze project was a project that was working against the “everyday-operation” wind. They existed because an ISO revision had remarks on the area but nobody really paid attention on their information or, were interested in their work. The project had 3 members and it had been around for a long time, succeeding to reach out only to a few of its target groups.

When the workshop was offered one of the members saw it as a chance to restart the implementation effort and a way to reload new energy. The workshop was held during 3 h and 45 min and the exercises of establishing the scope and making the implementation plan took longest time, about 45 minutes each. It was hard for the project to set success criteria, they had a final date when the project should be completed but this date was impossible to fulfill, even so they had problems to abandon it and set a realistic one.

The stakeholder analysis revealed many conflicts that explained why a successful implementation was hard to make; one reason was that a real owner did not exist; another was that target groups had very few viewable motivators.

In the exercises “whole product” and risk analysis questions of interpretation came up, for instance the risk
“not enough information to the parties concerned”. The group was very satisfied with the implementation plan, even if it was hard to set dates as it relied on a go decision from the steering committee.

The project found it valuable that the workshop points out the importance of reporting and informing all stakeholders. They also found it valuable with a risk analysis with implementation in focus. The fact that they got a documented summary of the workshop and the implementation plan was also considered very usable. They expressed that it was good for the discussion that the management was not present at the workshop.

It was suggested that some more consequences on the chosen strategy could be described in the exercises. The facilitators could get the project charter before the workshop to be familiar with the characteristics of the project and better be able to direct the discussion of scope and stakeholders. They also found the workshop a little too focused on application development and suggested to reformulate some of the exercises. They also saw a value in offering a follow-up workshop later in the project.

The key lessons:
- If your product is a push product (not demanded from the target groups) be careful in fining out the “carrots” for the users, and convince you sponsor the necessity of implementation efforts.
- Be clear in your exercises and eliminate as many candidates for interpretation as possible.

4.3. The Professionals

The professionals project was a project that was developing a new model for preliminary studies, both for projects that are resulting in an IT solution and others. The models main strength is that it helps its users to form basis for a decision.

The project was in a late stage when doing the workshop, the model was almost fully developed and they were about to engage pilots within the organization. Even so, they thought that they could have usage of some advise on how to spread their message.

The workshop was made with 3 persons, all professionals, and it lasted for 4 hours. Two of the members were seniors in the method area and they had a lot of experience with similar attempts.

The workshop went without any major problems; they had no problems with defining their scope, targets or criteria for success. The most extensive subject for discussion was the consequences of the scope. They had not got enough resources for reaching their targets and, through the workshop they got ammunition to convince their steering committee that they needed more resources.

Everybody agreed that the workshop was very good as it focuses on nothing else but implementation. They even thought the workshop could be ran at several occasions in a project, to catch different issues in different phases e.g. finding the roles and stakeholders in a project’s early stages. They liked the exercises as they gave different angles and approaches of implementation. They emphasized the exercises for placing the scope in time, the “whole product” and the value of getting an implementation plan. They thought that more than 4 hours workshop could be ok if a break was inserted. They found the risk analysis a little tricky, maybe because their project was a method project. Two of the members were new in the project and they were very satisfied to get a fast overview of the projects history, scope and targets. When following up on the actual implementation they founded out that the process went slower than expected. One reason was that it is very hard to find the right ambassadors for a product, find the ones with a “burning interest”. Also, the snowball effect they expected did not appear, they experienced that even when having a plan it was hard to implement the model. This project’s improvement suggestions were: Divide the targets in short and long term targets. Develop the strategy exercise with more advises and consequences. Also an idea came up of the value of having activities in an implementation project to “drop” old behavior before propagating out new.

The key lessons:
- When being well prepared you have ammunition to be able convince the most sceptical steering committee.
- Even for well-prepared professionals a workshop gives new angles and aha experiences.
- Implementation does not just happen; it takes time and requires a lot of effort.

4.4. The Hypotheticals

The hypothetical project was an R&D project. The goal for the project was to choose and verify a platform for server side Java used to web enable legacy applications. The workshop was made with 3 persons, all of them very engaged in the subject of spreading the message of Java while in the same time working in a R&D project where implementation by definition is not really included.

The workshop was therefore hypothetical in nature but the project got arguments to present to the steering committee, arguments that emphasized a new project with implementation as scope. This workshop was the first ever done and the facilitators had some problems with keeping the discussion on track and sometimes they got involved themselves in the issues. Even so the length of the workshop was 3,5 hours and afterwards the project members expressed that they were very satisfied with it.

The project found the workshop useful. Advises they got as “preparing different services for different target groups” gave them many aha-experiences and they used it
when presenting information on intranet and in smaller groups. Also, with the exercise of being forced to define their projects criterion for success, to have one and later be able to measure if the project reaches it, was considered very useful. Later they started a new project with implementation activities in focus. This projects objective is to gather all the method efforts made in the Java area and implement them into the organization. It has just started.

The key lessons:
- If you spend money on building something, you want other people to use it; every project should include implementation.
- Being a facilitator of a workshop is possible even with little experience, it is the workshop exercises that are the strength of the workshop. (Even though you get better for each time you facilitate.)

4.5. The Ostriches

The ostrich project was a project changing the process of handling a customer company’s applications and IT services. The project consisted of 10 persons, each with their own area of responsibility and with different opinions on the need of change and, what are worse, project members did not agree upon the extent of the change. The project manager had bit more than he could chew; he even thought that he could extend the scope of the project.

In this case the workshop was demanded to last for 4 hours, and it worked out well, even if it experienced to be a tight schedule. All 10 members were present and most of them were engaged in the discussions. The scope discussion took most of the time and was hardest to reach consensus on. Many of the identified activities were not really implementation activities but project activities; the members had some difficulties to see the difference between the two. A stakeholder analysis through a rich picture was done and many unresolved conflicts were uncovered and resulted in activities in the implementation plan.

They were very satisfied with the workshop; the best thing with it was that it gave a comprehensive picture of implementation. They also found the concept of being two facilitators guiding through and documenting the workshop as very valuable. When making the risk analysis they experienced some problems with weighting the risks in relation to each other, deciding what is most important or, is everything “most important”?

Regarding the length of the workshop they thought it could not be longer than 4-5 hours, if longer it would be hard to allocate people. They also agreed that the workshop should be incorporated in the project control model used within the company.

Based on interviews that were held seven months after the workshop the project had used little of the implementation plan though. The steering group had not contributed with needed resources and the implementation ended in a very shallow solution. One opinion was that it could give some advantages in having a representative from the steering committee in the workshop, this person could later bring the important issues to the steering groups agenda.

The key lessons:
- During an implementation workshop you cannot hide the scope of the project and the consequences of the scope.
- Keep the project activities separated from the implementation activities during a workshop.
- Emphasize the importance of explicit communication with the steering group.

4.6. The Entrepreneurs

The entrepreneurial project created a steering model for system maintenance projects within Volvo IT. The project was initiated from an ISO revision remark, even if the need has been partly identified by some of the target groups. Five persons worked in the project and three were present in the workshop. The project was in the late stage of the design phase and had hardly got any resources for implementation.

The workshop took 5 hours with a lunch break included. Long time was spent on different stakeholders views and interests and the fact that the steering committee was mainly interested in getting rid of the ISO remark versus the project members who saw the potential in putting some effort in changing the behavior in this area.

The project members thought that the workshop gave a useful rough implementation plan that was easy to develop further. It covered many important areas and had a good pedagogical approach. They emphasized the importance of the facilitators being sensitive on and note down the candidates for implementation activities during the workshop. The exercises covering risk analysis and the complexity of the product felt to be the most valuable and these two was identified to be bases for arguments to the steering committee. They also felt that it was good for the understanding of the whole project, to meet and discuss only implementation. On the con side they mentioned that the risk analysis as it in a couple of cases gave to much questions of interpretation and that it was hard to relate the weights of importance between the risks. This group wanted to do more implementation activities than they got resources to because they saw it as the only way to get a sustainable change in the area of maintenance practice.
The key lessons:
- When developing a product, implementation efforts on using it the intended way, increases the possibility to get paid back in valuable results.
- Taking a lunch break was positive; the members were not tired when starting with the last exercise and during most of the lunchtime issues from the workshop was discussed.

5. Evaluation

We have adopted and evaluated a systematic approach to improve diffusion practices in a software organization though the trial projects described above. The insights from these projects are discussed in the following and the results from the earlier diagnosis of current diffusion practices [4] is used as a baseline for evaluating the approach, i.e. the diffusion workshop.

All projects that participated in this evaluation had an immediate positive experience from the diffusion workshop. The discussions about scope and goals were most beneficial for projects in early stages, such as the satellites project. In some cases however it was difficult to face the fact that the project had a "mission impossible". None of the projects wanted to exclude any exercise, since they felt that all aspects covered in the workshop exercises were important. The documentation and rough implementation plan were also perceived as useful by all projects. It was, however, obvious that projects in early stages benefited more than those in later stages.

One or two members from all projects were interviewed again 3 to 6 months later and these interviews show that there has been an improvement in some areas identified as problematic in the diagnosis [4].

One major difference visible in projects that had participated in a diffusion workshop was that they had identified major stakeholders and target groups affected by their diffusion. This was not the case in any of the projects analyzed in 1999, which had not participated in a diffusion workshop. Stakeholders perceive technology in different ways [13] and when the various stakeholders are identified it is possible to initiate actions that improve the diffusion. There was also an increased focus on target groups in projects that had participated in a workshop. These projects had identified and defined different target groups and they had to some extent adapted information and education to different target groups needs.

All projects that participated in a diffusion workshop had also increased the number of ad-on services tied to their core product [11]. There was a lot of focus on establishing coaches that would help people to use the products diffused. Coaches enables the users to learn and adjust to change in a suitable pace, and supply 'point of need' support at their disposal [12]. Projects that had not participated in a workshop were in several cases trying to implement tools or methods without even providing training as a service.

Risk management of diffusion issues were part of the total project plan in the projects and these projects were better prepared to manage their diffusion. The participating projects also had a better dialog with their Steering Committees regarding diffusion issues and they were more successful in motivating the need for time and resources that would improve the diffusion effort. Fiascos commonly occur when senior managers believe a project has low implementation risk and IT project managers know or fear it has high implementation risk [14]. The diffusion workshop helped to reveal possible uncertainties.

Implementation strategies pros and cons were causing many discussions in the workshops. These made the project members realize that implementation does not just happen, it has to be planned and controlled [12].

The follow up interviews also showed that despite improvements in several areas there were still problems remaining with respect to implementation. Several of the interviewees reported that their project had lost the diffusion focus after a while and had failed to fully incorporate diffusion activities into their project plans. A follow-up workshop and mandatory project plan reviews were suggested as possible actions to manage these problems.

Many of the improvement suggestions that came from the pilot projects have been incorporated in the workshop e.g. adding examples for each implementation strategy; adding support material for the facilitators in order to eliminate interpretation uncertainties; the consequence weights in the risk analysis is set without seeing the values for likelihood; and a follow-up diffusion workshop is recommended.

The R&D project at Volvo IT has now reached the phase of implementation in the IDEAL model, shown in figure 1. Since a stepwise diffusion approach was chosen, the implementation workshop will be offered as a service to selected projects and after each workshop the facilitators will record feedback.

The phases in IDEAL has given us a framework to act within, each one shows what results are needed before the next can take place. The diagnosis provided arguments for trying Danske Bank’s diffusion workshop. However it also suggested that we needed to adapt the workshop in order to remedy the specific problems that CSM had. Later on, the diffusion workshop session conducted on the R&D project implied that pilot projects and a step-by-step diffusion should be used which is in line with the establishing and acting phases of the IDEAL model.

The workshop has so far had a positive impact in the organization, however it needs to be further diffused, evaluated, and validated. An important aspect to consider during the next phase is how we can institutionalize the
service as a sustainable effort at Volvo IT. This R&D effort is still on the first learning cycle of the IDEAL model, but to achieve a sustainable effort the learning suggested in IDEAL-model should never end. Our future work will be focusing on how this continuation can be achieved and how the workshop service can be continuously improved.

6. References