

# IMPROVING SOFTWARE DEVELOPMENT IN SME THROUGH KNOWLEDGE SHARING

## *A Practical Approach*

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**Keywords:** Knowledge Management, SME, Process Improvement, Experience Transfer, Knowledge Capitalization.

**Abstract:** To be competitive on a global market and especially in software development and software delivery, SME (Small and Medium-sized Enterprise) should capitalize on their internal know-how. Knowledge management should be present in any software process improvement in order to capitalize on past experiences and existing good practices instead of introducing a completely new way of working. Unfortunately, most knowledge management techniques are targeted towards big companies because they require a large amount of resources both in time, money and people involved in the process. In this paper, we present preliminary results of an experiment made with a set of SME developing and delivering software products. In this experiment, we helped these companies improving the management of their knowledge by providing them with lightweight knowledge management techniques, adapted to their size and their context.

## 1 INTRODUCTION

Knowledge management plays an important role in software process improvement and help companies to be more competitive. Capitalizing on experiences is often mandatory for business growth and even for business survival (Rasheed, 2005). Companies that have managed their knowledge can afford the retirement or the leaving of their skilled workers.

A company can choose between a number of different approaches to capture its internal knowledge (Handzic, 2006). One of these approaches is the REX method – where REX stands for “Return of Experience”. The objective of this method is to create “knowledge elements” like “experience elements” or “know how” issued from an activity. These elements are designed and recorded in knowledge repositories in order to be reused within the company.

Other approaches are using discussion groups and/or community of practices to encourage the experience sharing among their employees.

Unfortunately, these approaches are seldom adapted to the size and context of SME because they often require a big investment in time, people and money (Hermann and al, 2007). Also, the return on investment is often poor: for example, in the long

run, experience repositories only contain few articles and are no more maintained.

In this paper, we present first results on an experiment conducted with a set of Small and Medium sized Enterprises (SME) – enterprise from 1 to 50 employees – interested in improving their software development practices and delivery processes.

This paper is organised as follows: Section 2 describes the research method used for the experimentation, Section 3 addresses the knowledge sharing in software development, Section 4 describes the experiment in detail, Section 5 mentions related work, and finally, Section 6 concludes this paper with a list of future work.

## 2 ACTION RESEARCH

The research method that has been used is “action research” (Davison and al, 2004). In this method, researchers and practitioners work jointly on the development and testing of innovation techniques in a local context. The work is done in an iterative process of learning where researchers and SME partners collaborate. The objective of this collaboration is to identify, understand and solve their common problems. The iterative process

ensures the commitment of the actors as well as the quality and relevance of the research.

In our experiment the following steps have been planned:

1. A **diagnosis** of the current software development practices and identification of the issues that are surfaced due to lack of Knowledge Management;
2. A **planning** of the needed actions is elaborated (action planning) that takes into account the context and the motivation of SME;
3. An **intervention** (action taking) of the researcher is made. In this case, we propose to assist the companies in applying techniques for knowledge management that have been adapted to their size and practice level;
4. An **evaluation** of the situation after the intervention conducted with the employees involved in the action-taking phase;
5. A **reflection** on improvements that could be applied on the implemented technique.

The goal of the collaboration with the companies in the Action Research was to improve their current practices in software development by capitalizing on their past experiences. This experiment produced interesting feedback on the implementation and the adaptation of the described techniques in the context of an SME.

### 3 KNOWLEDGE SHARING IN SOFTWARE DEVELOPMENT

In this experiment our assumption was that the quality of the produced software (and consequently the satisfaction of the customer) could be increased by capitalizing on previous experiences of the company. Many improvement techniques, such as Total Quality Management (Boéri, 2000), rely on analysing past experiences (Zaharan, 1997) to foster improvement initiatives. SME involved in this experiment listed the lack of communication and knowledge sharing between team members as a root cause of major issues during their software development projects.

In order to capitalize on their know-how, the company should regularly record and refine the expertise accumulated on projects. Recording such

expertise is not an easy task for an SME, because in a competitive market such as software development, winning the next contract is often more important than analysing what went wrong in the past projects and how to avoid similar problems in future projects.

To record the expertises, two main strategies are commonly used: the *Codification strategy* and the *Personalization strategy* as described in (Henrie and Hedgepeth, 2003) and (Bixies, 2002). The *Codification strategy* is based on explicit knowledge – knowledge that has been codified in a knowledge repository. The *Personalization strategy* deals with tacit knowledge – mostly contained in employees' brains. The latter encourages employees to share their knowledge by maximizing the interactions between them; for example, by putting in place discussion groups or informal meetings.

For SME, the personalization strategy is often the most cost-effective way of transferring experience. However, there are only a few guidelines as explained in (Hermann and al, 2007) that are designed explicitly for SME.

## 4 APPLYING ACTION RESEARCH IN KNOWLEDGE MANAGEMENT

This section describes the first two activities completed so far. They were conducted in order to propose such appropriate guidelines:

- Diagnosing the current knowledge management practices;
- Planning the needed actions and writing knowledge management techniques for experimentation.

### 4.1 Diagnosis: SME Needs

The first phase was to collect SME needs on knowledge management techniques. To do this, a questionnaire was created and used to collect requirements from SME about software improvement process and knowledge management. The elaboration of the questionnaire and the first results of the survey were published in (Bjørnson and Dingsøyr, 2009). This questionnaire addressed the current and future interests in knowledge management among 15 SME active in software development and delivery. The questionnaire was designed in such a way that any company could understand it and provide useful input.

The core of the questionnaire was about the current and future interests of the SME in knowledge management schools described in the remaining of this section. More specifically, the questions were a set of statements concerning approaches to knowledge management. For each statement, the SME were asked to state how well this statement fits in:

- the current situation inside the company
- the future importance in the company in a mid-term (3 years)

The statements concerned the following knowledge management approaches/schools as described in (Earl, 2001):

- *The System school*: using knowledge bases;
- *The Cartographic school*: using yellow pages;
- *The Engineering school*: using procedures;
- *The Organizational school*: using discussion groups;
- *The Spatial school*: adapting the work environment.

A *gap analysis* – an analysis of the difference between the scores given in two situations – was carried out to compare the current and future interests of all the interviewed SME about statements linked to the listed knowledge management schools. Figure 1 presents the outcome of this gap analysis for all interviewed SME.

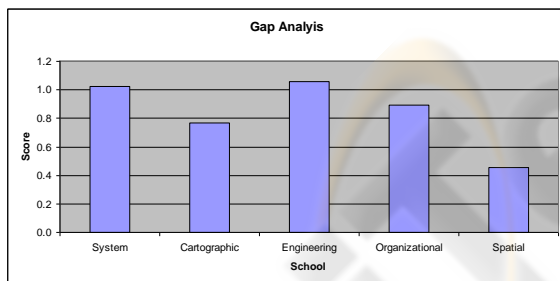


Figure 1: Combined gap analysis.

For example, in this case, the spatial school had the lowest gap with 0.41; this means that on average the score given by SME to current and future interest about the implementation of techniques from the *Spatial School* are quite close. This experiment showed that the *System school*, the *Engineering school* and the *Organizational school* had the greatest gaps.

## 4.2 Planning: From the Assessment to the Knowledge Technique

The methodology is based on the framework of (Habra and al, 1999). This framework is depicted in Figure 2 and it explains that any software process improvement has to adhere to the company’s goal. In this experiment, the section of the questionnaire about the current and future interests in knowledge management approaches tried to extract the success factors that are already present in the interviewed SME. These success factors are related to the management, the current practices in software development, and the allocated resources – time, people and money. They constitute the basis for the software process improvement that facilitates improved practices, hence contributing to the satisfaction with the software’s goal and also with the company’s goal.

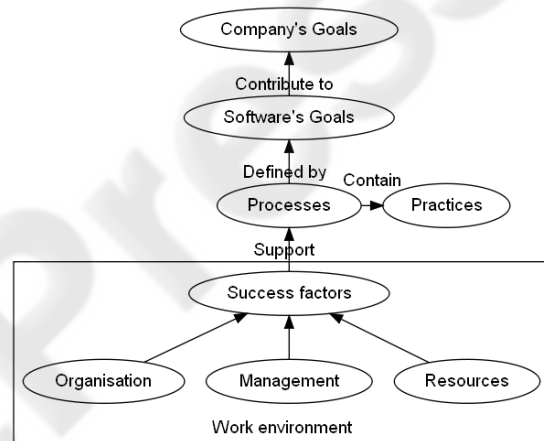


Figure 2: Framework for software process improvement.

The level of practice is derived by analyzing the answers given by a company related to its “current situation”.

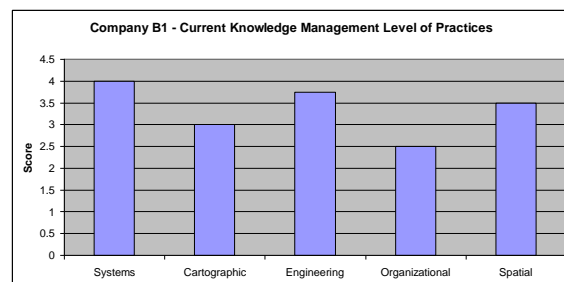


Figure 3: Current Knowledge Management Level of Practice.

In Figure 3, Company B1 declares that it has a high level of practice in Systems schools techniques for knowledge management, and a lower level of practice in techniques from the Organizational school. Hence a technique related to this school was proposed to Company B1.

## 5 RELATED WORKS

Our work is related to the activities of the ISO/IEC JTC1-SC7 working group 24 (WG24). This working group was created to address the application of standards among Very Small Enterprises – from 1 to 9 employees. Like many knowledge management techniques, the ISO standards target the large companies and are not adapted to the size and the maturity level of the VSE. The objective of WG24 is to adapt existing standard to the needs of VSE. (Laporte, Alexandre, and Renault, 2008).

As in (Handzic, 2006) this experiment showed that a Knowledge Management initiative should be aligned with the overall business strategy to attain success. As suggested, an audit on the current knowledge assets and resources should be made.

## 6 CONCLUSIONS AND FUTURE WORK

SME need practical knowledge management techniques but unfortunately, current techniques are seldom adapted to their size and context.

In order to fill this gap, we performed an experiment conducted with SME active in software development and delivery using the action research paradigm that consisted of the following phases:

- **Diagnosis** of the current knowledge management practices: we collected and analysed the requirements from the SME
- **Planning** of the needed actions: it consisted of the research and writing of suitable knowledge management techniques that we presented to SME for internal application.

At this time, it is difficult to draw conclusions on the results, given the small sample of interviewed SME. The following steps are still to be taken:

- Implementation of the technique by SME and collecting of feedback on the actual application of the technique.

- Evaluation of the situation after the implementation of the technique
- Reflection and improvement on the implemented technique

In many cases, the interviewed SME had difficulties to identify its actual needs in knowledge management techniques. The questionnaire will be improved with a section allowing a quick assessment of the current situation in the implementation of good practices in knowledge management. This assessment will help SME to identify the appropriate knowledge management technique to be implemented on the basis of their respective scores.

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