Software Process Improvement for Small Structures : First Results of a Micro-Assessment Framework

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Abstract

*This paper relates a technology transfer experience which aims at initiating a Software Process Improvement focus in small or medium organizations (SME). The initiative was born from a European interregional collaboration between two university research teams (France and Belgium) and a public research center (Great Duchy of Luxembourg). The project is founded by the Walloon Government on the OWPL[1] name. The project works with a close collaboration with other projects like SPIRAL*NET[2] which aims at optimizing and generalizing best software practices in the three regions. The global objective of this experience is the design of a SPI approach particularly adapted to small businesses, organizations and projects on the one hand, and to improve the visibility and the access to structured information related to the regional software market on the other hand. We adopted a gradual approach which consists in three successive stages : a Micro-Assessment framework, a tailoring of CMM and SPICE, and a SPICE evaluation. This paper presents the first results of the Micro-Assessment stage and some criterions to tailor great SPI models according to this particular context.*

1. Introduction

The SPI approach we propose addresses mainly small and medium enterprises (SME) and small public organizations of the Walloon region, i.e. the French speaking part of Belgium, together with SME from the bigger area composed by Wallonia, the Grand Duchy of Luxembourg and the French Lorraine. Wallonia is one of the oldest industrial regions in Europe. Similarly to other old European industrial basins, the region suffers from heavy aged industrial structures, e.g., iron and steel industry, coal-mining… The region is achieving a phase of slow conversion to modern industrial structures including small businesses active, among other, in the domain of Information Technology (IT).

The main characteristics of the walloon region are the persistence of some old-fashioned bureaucratic management style, the coexistence of new small dynamic businesses and old big industries, the small size of IT businesses and the very small size of the majority of IT units in other industries and in public organizations.

A regional study made by the Technology Assessment Group (CITA) of our university about Walloon SME [1] gives some significant data : in about 30% of businesses, only one person has software (in general) in his charge; and among the SME developing and/or managing Information Technology, 60% achieve these tasks with less than 5 persons. Such a very small size makes businesses highly dependent on some projects, some actors and/or on some technical capabilities, though they are sometime very innovative in their domains.

The French Lorraine and partially the Grand Duchy of Luxembourg have similar old industrial basins structures. However, the phase of conversion to modern industries seems more advanced in these regions, particularly in the Grand Duchy of Luxembourg which benefits from the European Institutions and a very dynamic banking market place.

The whole region is evolving in a European context where the market is more and more open, and consequently, with an increasing competition. In this context, it is obvious that software quality in general becomes a crucial issue for Walloon SME even though their resources are very limited.

[1] The acronym OWPL stands for Obsrevatoire Wallon des Pratiques Logicielles, i.e., *Walloon Observatory for Software Practice*s .

[2] SPIRAL*NET is the ESSI ESBNET project 27884.

2. Small structures and SPI

A typical activity of the focused small structures is to provide customer specific solutions targeted for businesses or specialized parts of larger systems. It's very important for these structures to produce quality software since it will determine the quality of the business or the quality of the whole system. Although small structures are now taking a major part in the software market and produce several and critical products, software quality improvements have been generally the interest of bigger organizations [14]. In fact, standard models like CMM are initially designed for very big structures. So, they should be more or less deeply tailored and/or adapted to very small organizations. The first reason is the cost of an evaluation process (+/- 25000 USD) and its duration (+/- 8 months) [2] which are disproportional to the available resources. In addition, the maturity level our target SME would get according to a general assessment model like CMM would be very low, and this is discouraging because it's known in advance. Brodman and Johnson ([3],[4]) shown that a great number of process improvement plans based on the CMM encountered problems and that an important rate of those problems (53%) were related to the size. The success of a CMM process improvement plan actually grows with the number of people having software process in charge.

There is also a similar need of adaptation with the SPICE model, even though this model is supposed to be suitable to SME. The cost and effort remain too much important for very small organizations. A very simple adapted model would be more suited for them (at least) as a starting point.
Another important point lies in that the number of actors involved in software process is very small. Several roles can be in charge of the same single person. This makes the use of such models very complex for small organizations. In addition, actors in SME are far from being all Software Engineering specialists; so adapting the vocabulary is necessary to allow the model to be used for self-assessment or for an assessment with a light support.

3. The Gradual Approach

The adopted approach is a gradual one, in an evolving context. First, we use a Micro-Assessment Framework to collect information about the current software practices in small structures. At the same time, we try to make the managers sensitive to the importance of software quality aspects. There is a permanent contact with the SME in order to accompany the improvement process. All the information collected is then gathered and used as a starting point to build a tailored model suited to the context of small structures. Companies with a medium/high quality level are eventually invited to call out a CMM or SPICE evaluation.

4. The Micro-Assessment Framework

The Micro-Assessment model is designed to have as lowest cost as possible though giving a first pertinent diagnostic of the software practices in the assessed organization. The rationale is twofold : to make the assessed SME aware of its weakness but also of the potential effective improvement it can expect, on the one hand, and to determine the priorities of subsequent stages of evaluation and improvement procedures, on the other hand. The designed model uses an interview based on a questionnaire which covers six key axes selected as the most pertinent and the most prior to the targeted organizations on basis of former experience with SME evaluation. These axes are the following :

1. Quality assurance,
2. Customers management,
3. Subcontractors management,
4. Project management,
5. Product management, and
6. Training and human resources management.

The questionnaire includes a few dozens of questions covering the axes above. Questions are open, and each of them is associated with one or more sub-questions allowing the interviewer, if need be, to adjust and refine the information he gets.

4.1. The Micro-Assessment Process

The Micro-Assessment process begins with a SPI information session during which we explain the cogency of SPI initiatives and justify the necessary investment. The companies that decide to undertake an improvement process are contacted for a 30-minute phone interview. This makes possible the collection of information on the six axes with maximum reliability and minimum cost.

The interview is much more efficient than a self-assessment as it allows the interviewer to adapt the vocabulary according to the interviewee and prevents questions from being misunderstood. This way, the interview can be considered as an exchange of information rather than an audit job.

The assessment is performed by members of our software quality team, the interviewed person should be the one who has the software quality in his charges in the evaluated organizations ; and this corresponds usually to one of the executive staff members or to the quality engineer, if this function exists.

Answers are interpreted according to a fixed grid. Two types of questions can be distinguished. On the one hand, questions that concern essential practices related to the general organization are rated on a linear scale according to the quality of the practice assessed. On the other hand, questions that concern the software practices are rated in a double-entry grid according to the quality of the practice and to its effective implementation in the evaluated organization (only for some critical projects or for all projects). Detailed description of the micro-model can be found in [13].

The produced report summarizes the current state of software practices together with some recommendations to improve the quality of these practices. The process is repeatable. A new Micro-Assessment can be carried out every six months to detect any evolution of practices.

4.2. The Micro-Assessment Report

The result of the micro-evaluation is drawn up in a report of a dozen of pages. The report contains an introductory part describing the SME environment and the circumstances which led to the Micro-Assessment framework. It then first briefly presents the approach, then it develops the results of the questionnaire and summarizes them according to the six axes, then it analyses those results according to the context of the evaluated organization (the age, the history, the declared goals,..) and finally gives some recommendations to help the assessed unit to improve. A list of the main strengths and weaknesses according to the SPI principles is also drawn. The report is confidential and sent to the person who led the Micro-Assessment process on the SME's side.

4.3. First round of the Micro-Assessments

The Micro-Assessment has been experimented on a sample of two dozens of organizations (IT small companies, IT services in other businesses, public administrations using IT). We agree this sample is not sufficiently representative but the diversity of processes observed seems characterizing all SME's software practices. Figure 1 below gives an example of the results grids. The first grid shows the detailed evaluation results according to the selected practices while the second one summarizes them according to the six selected axes. One can notice that the case shows an evident weakness in the software development process itself. This corresponds actually to an amateurish development without any well-distinguished phase nor any notion of a lifecycle. Though, this unit has some strength in the subcontractors management process, for example. A software process improvement for this unit should obviously start by the elaboration of development methodology.

We could draw the following conclusions after the first round of the Micro-Assessments :

- A third of the assessed SME is aware of software quality aspects and has a quality system with a Manual of Quality and other well defined and documented procedures. Some of them are preparing an ISO-9001 certification and several of their practices are highly efficient notably those related to the customer/client management and product management.
- Others present a lack of formalism and, in particular a lack of planning process. There is no training program and success highly depends on individual skills

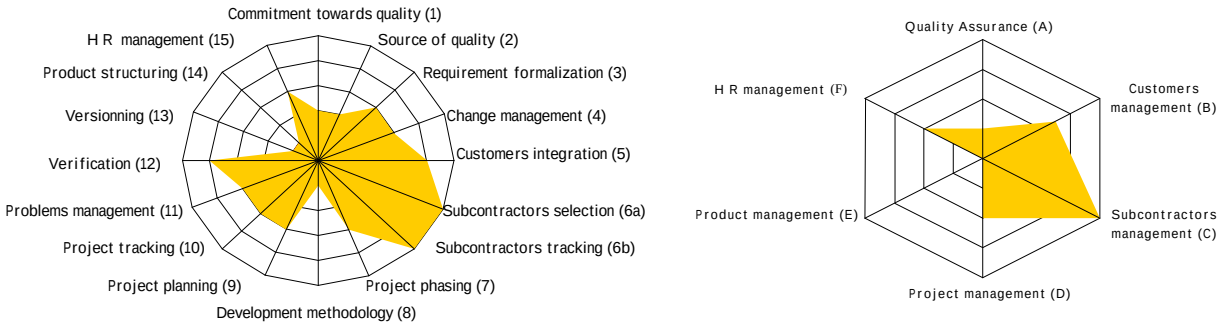

Figure 1

4.4. Second round of the Micro-Assessments

At this time, five SME have tested the experiment for the second time. Figures 2 and 3 show second round Micro-Assessment grids (**2R MA Results** on figure) which summarize advances and/or drops relatively to the results of the first Micro-Assessment (**1R MA Results** on figure).
An overview of the second results allow us the following conclusions :

- Globally, efforts have been made to take our recommendations into account. People are willing to improve even though resources (human resources) are still limited.
- In most cases, the good practices observed (and drawn in the first report) have been enhanced and spread on all ongoing projects. Assessed SME began a definition of some procedures in order to save outcome of this SPI initiative.
- SME are now aware of SPI topic. There's a real culture of quality.
- There is only one drop in quality for one SME which has both internal and external clients. As there was an exceptional growth in the number of external clients, they focused all efforts to define and monitor procedures to improve the quality of the service offered to these external clients while the internal clients were getting service of poorer quality (Figure 3).

Figure 2 shows a SME that really improved though some practices are still at the lowest level.

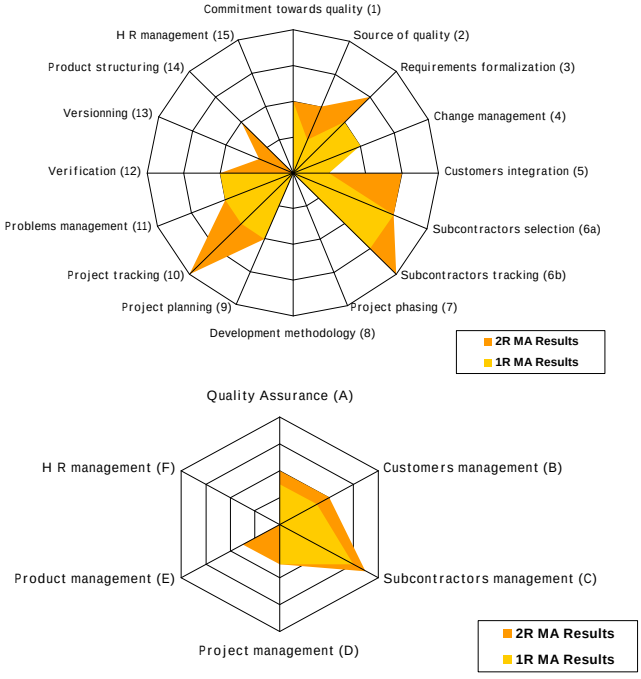

Figure 2

On Figure 3 one can notice that an important effort has been made. This company could not stand such an effort and Project Phasing and HR Management were left behind to concentrate on the other axes. This figure corresponds to a mature unit, which can expect, in the middle term, a good result after an evaluation according to a more complete model.

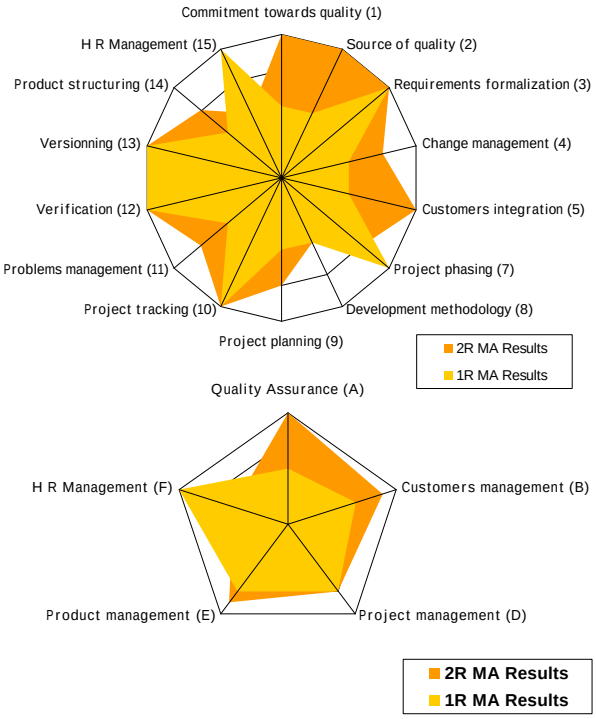

Figure 3

5. Toward A Tailored Model

Introducing this paper, we underlined the necessity of tailoring standard and complex quality models to make them suited to small organizations. Advances in SPI (CMM, SPICE models for instance) are primarily addressed to the big structures and our two Micro-Assessment framework rounds reinforced this opinion. The analysis of the Micro-Assessment outcomes allows us to draw some criterions for an efficient tailoring process. They are summarized bellow :

- The tailored model should focus on *evolution* aspects rather than on *certification* ones. In fact, small organizations would probably get a very low maturity level according to the CMM, for example. Though, they need to know their strengths and their weaknesses and they have a dramatic need of guidelines to improve their processes.
- The tailored model should use a simplified vocabulary. In fact, certain terms used in the classical models (or at least their French translation) appear too technical and troublesome.

- More generally, forms and questionnaires should be simplified to avoid that the model use appears as a cumbersome task involving an extra bureaucratic work (see e.g., [5]). Small business resources are too few and necessary to their immediate production tasks.
- The model should clearly indicate that the different terms used for the task description designate different roles but not necessarily different persons as different tasks in several practices of the model are considered to be possibly (and even likely) assigned to the same person. The fact that different tasks are (or should be) assigned to different persons should be given explicitly.
- The tailored model should emphasize the importance for an organization to define explicitly its objectives in general and those of its software process in particular. The model should invite the assessed organization to refine its objectives into goals and sub-goals and to relate them to the processes and the practices of the tailored model. Making explicit the relation between the outcomes to the processes and the practices of the tailored model on the one hand, and the organization declared goals on the other hand, should be motivating in the improvement process. (The importance of making explicit the definition of goal is pointed out by the GQM approach [6][7]).
- The tailored model should be associated with methodological guidelines concerning the software process evaluation as well as the SPI information sessions (awareness actions), success factors (organization, structure, technology, management principles, human resources etc.), the communication of the results and so on.

The second phase of our gradual approach was the definition of such a tailored model. The OWPL model has been developed this year and is actually being experimented on the field.

6. Conclusion

Current software practices in most of small businesses are far from being well defined and the lack of available resources compromise the success of any SPI approach based on a model like CMM or SPICE. However, it’s possible to undertake a SPI process and to make a real progress without high investment.

The experience shows that the Micro-Assessment model is very attractive as a tool to start with, mainly because of its extreme simplicity, because it helps draw people's attention on the problem of quality in the field of software engineering, and because it can help draw a list of effective recommendations to guide them in the first steps of improvement.

For those small companies looking for a more exhaustive model, the OWPL model should be the correct answer as it has been developed taking CMM and SPICE as references on the one hand, and the SME specificity's highlighted thanks to the Micro-Assessment framework on the other hand.

7. References

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