Quality through managed improvement and measurement (QMIM). Towards a phased development and implementation of a quality management system for a software company

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Quality through Managed Improvement and Measurement (QMIM): Towards a Phased Development and Implementation of a Quality Management System for a Software Company

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Abstract. The paper describes results of a longitudinal study of developments in the area of software product and process quality improvement within a Hungarian software company, IQSOFT Ltd. This company has been active in this area since 1993, trying to build, introduce and maintain an efficiently working quality management system which, e.g., fulfils the ISO 9001 requirements, allows steady software process improvement and, at the same time, conforms to company's own needs. Over the last eight years five phases could be distinguished. Each phase is described shortly, following the same structure, namely: basic starting points, key problem areas, literature consulted, activities and design executed, reflections on what happened and why. The lessons resulting from the analysis of this case have been formulated in terms of guidelines. We feel that these are applicable to any low maturity software development organisation embarking on a product or process quality improvement endeavour. These guidelines are developed around a framework containing the basic issues of software production (project management, technical processes and products). The guidelines advocate a careful step-by-step development of definitions, quality characteristics, and metrics related to these objects while at the same time developing and introducing the associated process.

Keywords: product and process quality, quality management system, improvement, measurement, longitudinal case study

1. Development and implementation of a quality management system: The case study

1.1. IQSOFT Ltd., the environment of the case study

IQSOFT Intelligent Software Computing Technology Manufacturing and Trading Co. Ltd. (IQSOFT Ltd.) is one of the main representatives of the software industry in Hungary. The company was formed in early 1990 from part of large state organisation, the Theoretical Laboratory within the Computer Technology Co-ordination Institute (SZKI). The company is a medium-sized one, having at present 74 employees.

IQSOFT Ltd. has three main software activity types: software development (mainly in a database environment, using 4GL development tools), software integration,

and software implementation. The projects are generally small to medium size and can differ widely in their characteristics. Research and training are also important activities in the company's activity profile.

In this environment an eight years longitudinal case study has been done, lasting from 1993 to 2000. The aim of the company was, of course, not running a case study but building, introducing, and maintaining an internal quality management system. This has proven to be more complicated than expected. Although initially the aim was to obtain an ISO 9001 registration, later the drive shifted with registration only seen as a *possible outcome* of these activities, a desirable but not primary one. It is interesting to notice already at this point that the most important result, namely a change in the way of thinking about software quality, has been obtained in the phases before the company got registered in 1998. The case study continued after the registration by continuing process improvement at IQSOFT.

The case study can be distinguished into five phases:

- The enthusiastic start, dealing with quality (1993–1994);
- Seeking new ways and means (1995);
- The successful recommence (late 1995–mid 1997);
- The new ISO 9001 project (mid 1997–April 1998);
- Continuous process improvement (May 1998–2000).

In the following sections, we will describe these phases into more detail.

1.2. Phase 1: The enthusiastic start, dealing with quality

Since 1993, efforts have been made at IQSOFT to develop and introduce an internal QMS. The basic reason of the IQSOFT's management decision was—by that time—the emerging request to be ISO-certified, formulated by a (potential) foreign customer. At that time, no Hungarian software company was registered according to ISO 9001, so it would have been a strategic advantage to be the first registered Hungarian software company.

The quality-oriented activities at IQSOFT started low profile, having only a PhD student, working part time at the company and responsible for doing all the work. The quality approach was the process-based one, as suggested by ISO 9000 series (ISO 9001, 1991). We found that the efforts made in building up and introducing a QMS at IQSOFT did not produce the desired results. At the beginning of 1994 all basic quality documentation had been finalised. However, as management did not make their usage mandatory, they remained practically unused. Though the documentation set was ISO 9001—conform, there was a huge gap between ISO 9001 prescriptions used in the documentation and real life practices. This was confirmed later in 1994 when the overall company and two concrete projects were assessed according to the Bootstrap methodology (Kuvaja et al., 1994). This approach uses a CMM-type scale (Humphrey, 1989). The results of this assessment pointed out that the whole organisation was situated on level 1.25, with some of the activities

(such as detailed planning, project management and usage of development model) raised above level 2.

We believed at that time that the main reasons for the slow adaptation of new procedures were threefold. A first reason was the diversity of projects. Our biggest problem was our inability to order and classify the company's projects: they all seemed to be unique, giving us no chance to put them in a common framework. We remarked that ISO 9001 "was not working" at our company. We had prescriptions, without telling us what to do and in what sequence, in structuring things at IQSOFT (further details about this period in Balla [1994, 1995]).

A second reason was seen to exist in the human factors dimension. Software developers were resisting introduction of standard prescriptions. These were perceived as providing extra work and being needlessly complicating and were therefore not judged to be efficient. Management did little to help here. The original motivation to obtain ISO-9000 certification had faded along with the prospective foreign customer, and management commitment had all but disappeared.

The third reason was that participants in the project realised that they had an insufficient understanding of quality issues. The ISO-standard was carefully "learned," but not clearly understood. Lacking the necessary theoretical and practical knowledge about the subject, the phasing and timing of the work was done more or less, arbitrary. There was insufficient understanding about what exactly had to be done, in what order it should be done, and what the result would be.

1.3. Phase 2: Seeking new ways and means

Experiencing the "failure" of the quality-exercise, the management and the employees became skeptical about the possibility of improving daily practices. Quality activities were not stopped, but became a kind of background activities, limited to research in the domain. In this "learning and assessment phase" a better understanding of quality issues as well as the current situation at IQSOFT with regard to these issues was obtained. Among others, the limitations of the static process approach of ISO-9000 became clear. Other entities such as product and resource also need to be regarded (Fenton, 1992). Before these entities would be understood, precise definitions would be needed (which seldom exist) and relevant quality attributes would need to be identified. We placed all these elements into a matrix,

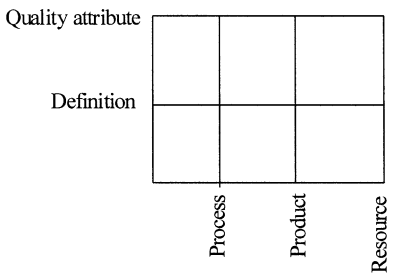

Figure 1. The chosen quality framework.

representing our "chosen quality framework" (see Figure 1). The word "chosen" indicated in fact, that we wanted to look to quality through this framework: we wanted to deal with the quality of all objects. Yet, it was not clear *how* it would be possible to do this although in many articles (e.g., Kusters et al., 1993, Trienekens and Thoma, 1994), we found arguments for building the quality systems in a customised way, taking into account the company's own needs.

1.4. Phase 3: The successful recommence

After this learning and assessment phase we were in a good position to take advantage of a lucky opportunity: in 1995 IQSOFT—always eager to co-operate in international research projects—won an EU PHARE tender "Technology Development and Quality Management (TD&QM)," thus gaining (also financial) support for quality oriented activities, That was the beginning of the so-called IQPM^2 project.

IQSOFT management was now aware of the fact that it was impossible to introduce a QMS at once. So, also taking into account the results of the Bootstrap assessment, they decided to use the opportunity to introduce a project management methodology. Taking into account the former co-operation with Lucas Management Systems, the PM^2 methodology of this company, distributed by Metier Plancon (NL), was chosen for supporting the project. So, IQPM^2 project was started with the basic goal to introduce a company-wide project management system at IQSOFT.

The project started in February 1996 and finished in May 1997. The project team was composed of 13 members. The activities of the IQPM^2 project have been performed in the sequence suggested by the PM^2 methodology.

The basic phases were: awareness and requirements gathering, development of project management standards and procedures, solution definition and implementation of a software tool, testing the developed standards and procedures in baseline projects, measuring and evaluating the results, improving the standards and procedures according to the results obtained in the baseline projects. We can state that the IQPM^2 project was successful: it reached its goal within the planned time and budget limits. This was confirmed by a Bootstrap assessment carried out in 1997. It showed the overall organisation had the maturity level 2, while the pilot projects reached 2.50. Issues related to organisation were situated on level 3; life cycle independent functions and process related functions reached level 2.75. Compared to the assessment made in 1994, this Bootstrap assessment showed an increase especially on those fields related to the IQPM^2 project goals: organisation, description of standards and procedures, project management practices. This increase supported management's belief that we were moving in the right direction.

When looking back at this phase we could identify a number of factors (i.e., our lessons learned) influencing the successful outcome:

- The first lesson learned was that a learning and assessment phase has to provide a sound basis in understanding and knowledge on which future efforts can be built;

- Secondly we concluded that an important factor contributing towards success is a very strong management support, which attaches a high priority to the project. Management in our situation had sound business reasons to sponsor the project, had formulated and communicated clear project goals and had initiated a well-managed project to achieve these goals. Furthermore, throughout the project management visibly demonstrated commitment to this project. This management approach stood in stark contrast to the earlier approach exhibited in phase 1;
- The third lesson learned was the involvement of the staff. During phase 3 in our project it became obvious that there were serious communication problems within the company (e.g., employees were not aware of the management's requirements regarding their work). A first step taken to alleviate this was to keep all employees informed during the whole project about its evolution. Furthermore, explicit attention, time and funding were given to training. Finally, all members of the management plus eight project leaders worked together in defining the needs, in putting things on paper, and in trying out the newly written prescriptions in real projects. As a result, they were more receptive and interested in the results. We could notice a diminishment of the previously hostile or passive attitude towards all quality-issues at the company, a legacy of the problems encountered in phase 1;
- Fourthly, although an established methodology was used as the basis for the project this method was not just adopted, we learned it should also be adapted to the specific requirements of the business situation at hand, i.e., at IQSOFT. In our project this (adapted) methodology was tested in a number of pilot projects. The visibly positive effects of these pilots also contributed to the success of the project. Also, involving people in these adaptation activities gave more people the feeling that they contributed to the development of the standards. This proved an effective means of furthering commitment. We can state that IQpm[2] project changed the mentality about standardization of the majority of IQSOFT employees: people saw that it was possible to work out a set of really useful standards and prescriptions that were really helpful for their work (a more detailed description of the activities and results of the project can be found in Balla and Langer [1997a, 1997b]) and became more receptive regarding these prescriptions;
- Finally, the development of a handbook, containing the description of the IQSOFT organisation, the possible positions, functions, roles and responsibilities, brought again to light the problem encountered in phase 1: the inability to identify distinct software development processes. We learned that the processes of a software company could be—in our case: should be—divided into at least two distinct activity types: *project management processes* and *technical processes*. Project management processes are those concerned with the successful management of the project, regardless to what technical activities (e.g., system development, system integration, support etc.) are being done in the project. Technical processes are concerned with the technical work done in the project. In specific projects both activity types can be combined (see Figure 2).

  An important justification for separating was that project management activities in our company were more stable than the technical ones. With the standardisation of project management activities—building the (single!) project management model of the company—we made the first important step towards

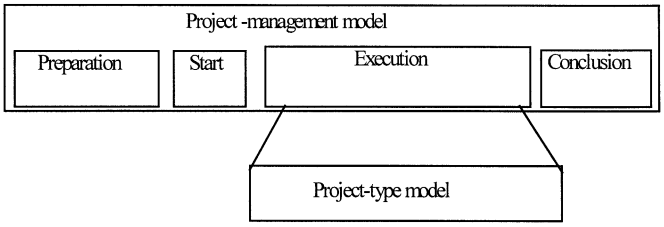

Figure 2. Project model at IQSOFT.

bringing order in IQSOFT. At that moment we consciously left the technical activities undefined, just grouping them into several "project types," which would be worked out later. However, we did find at this time that there were just a few, well definable project types (development project, system integration project, implementation project, research project). This strengthened again the belief that it was possible to structure the company's activities and gave us a handle to deal with diversity and complexity as perceived during phase 1.

Based on this last lesson learned in this phase, we regrouped Fenton's entities (in our framework presented in the previous section) into the following objects: *Project Management* (PM), *Technical Process* (TP), and *Product* (P).

The basic reason for this regrouping was the fact that the objects we were talking about were not Fenton's "technical" objects, but were more "business" objects. Fenton's "resources" were incorporated into project management, because we considered that all resource-related subjects were addressed within the project management issues.

We identified the horizontal dimension of the matrix presented in Figure 1 as the "object" dimension. It changed, now having the elements: *Project Management* (PM), *Technical Process* (TP) and *Product* (P) (see Figure 3). The vertical dimension remained unchanged. We named it the "*quality-specification*" dimension.

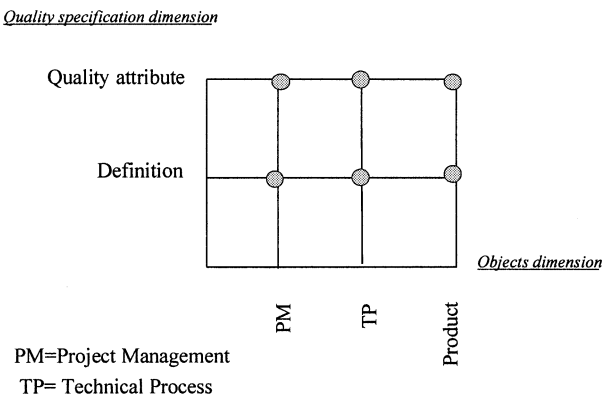

Figure 3. The changed quality framework.

1.5. Phase 4: The new ISO 9001 project

With the positive experiences of phase 3, IQSOFT's management decided to go again for ISO 9001 registration. This decision was a logic consequence of the results obtained in the previous phase. On the one hand, a CMM level close to 3 is said by the literature to conform more or less to an ISO 9001 level. On the other hand, it was clear what had to be done: the project model developed in phase 3 had to be completed with the type models, the non-project-related activities had to be standardised as well. A very important fact was that the employees were accepting the need for an organised way of working.

The situation on the software market had also changed since IQSOFT's first attempt to register: by November, 1997, six Hungarian software companies had been registered according to ISO 9001. Being registered was not a novelty any more, while not being registered started to be a serious handicap.

On this basis a project was started to obtain registration. It can be called a "new approach" project because it had the scope of obtaining ISO 9001 certification using all former experience of IQSOFT in building a customised QMS. The project was declared a top-priority. A project owner, the technical director, formed the project team. One of the authors was declared project leader, and 10 project members—one representative for each of IQSOFT's departments—spent part of their time working on the type-models of their departments. The estimated internal effort was 250 man-days. The official start date of the project was preceded by two training sessions: an internal auditor course was organised for all project members, and a course attended by the top management and the leaders of the different departments. The members of IQSOFT management and the leaders of the departments were continuously kept informed about the project.

The decision was that the QMS should include all activities/departments of IQSOFT. The quality management system referred to: software development, software implementation and system integration. It is important to show the structure of IQSOFT's internal QMS: it follows the recommendations of the ISO standards, but it is built to fit the specific needs of the company itself. A basic idea underlying the QMS was that project-related processes could be distinguished from non project-related processes. Describing "non project-related processes" was easier: the processes related to sales, training, computer system administration and secretariat were relatively well defined. Having the experience of the IQPM^2 project, project-related processes were separated into project management and technical processes. This way, a company-wide standardisation became possible: the project management standards—which were worked out earlier, within the IQPM^2 project—were valid for all projects. Technical differences between projects were described in the so-called "project type models."

The quality management system was fully operational beginning with February 1998. The final audit for the registration took place in April 1998, and it was successful. The ISO 9001 project has been evaluated to be a successful one. It reached its goals within the planned time and cost limits, and it produced the planned results.

When discussing this project we can first compare this certification effort with the one attempted in phase 1. Here we can notice a marked difference. As it was formulated at the time, the goal of the (phase 4) project was to get the company registered according to ISO 9001 and to do this by building a customized quality management system that takes into account the needs of the company as well as the results of theoretical research done in the field. Although undoubtedly commercially important, certification was no longer seen as an isolated activity but as part of the development of a QMS, stimulating improvement of process and product quality.

If we look at the certification project we can identify the same success factors (i.e., our lessons learned) that were already noted in the previous phase. In the starting conditions for the project we see:

- a solid understanding of the current position;
- the existence of a clear business case;
- the transition of this business case into a set of clear and operational goals;
- a solid project approach;
- time and effort being spent on training.

Furthermore in project execution we see:

- active, visible management commitment, as shown, e.g., in management attending training sessions;
- continuous and explicit communication with the staff about the project from its inception to its conclusion;
- active participation by the staff by involvement in project execution, soliciting feedback on intermediate results and modification of the basis of this feedback;
- adaptation of the QMS to the specific requirements of IQSOFT.

To this can be added that the positive conclusion of the previous phase had resulted in a positive attitude among the staff for this type of project. There was no evident opposition from any departments; passive opposition (characterised mainly by the absence of co-operation) was rarely observed. The employees accepted working in a standardized way.

1.6. Phase 5: Continuous process improvement at IQSOFT Ltd.

The QMS built in phase four has been used actively ever since. This fact is shown by the relatively high number of requests for changes in the prescriptions, templates, employees' propositions and problems raised in connection with the QMS. The procedures are updated to fit the modified practice, and, as new practice is being observed, new ideas are introduced to make things work better. This shows that the QMS is a living entity within the organisation. Improvements in work practice are immediately added to the QMS. Some data on usage of the quality management system in 1998 to 2000 are shown in Table 1.

Table 1. Some figures about usage of the QMS in 1998–2000

Data related to the QMS	1998	1999	2000
New issue of the prescriptions	65 times	16 times	23 times
New issue of the templates and models	37 times	6 times	9 times
No. of external audits affecting the company	3	1	1
No. of internal audits of departments	23	25	27
Nonconformities found:			
During external audits	8	2	0
During internal audits	34	94	63
Ad-hoc	26	3	3
Purchaser reclamation	3 times	6 times	1 time
Employees' propositions and problems raised in connection with QMS	72	87	22
Quality—oriented training	Appr. 30 days	Appr. 30 days	Appr. 30 days
All effort related to quality management	319 man-days	121 man-days	150 man-days

According to the evaluations, working in conformance with the prescriptions of the quality management system causes about 30% of extra effort in small projects, and about 10–20% in the bigger projects. The advantages were perceived to outweigh these costs. Data on customer complaints and audit results seem to support this perception.

IQSOFT did not see ISO 9001 certification as an end result. It was felt that a continuing effort in the quality area was required. To aim this effort we first took another look at the framework as presented in Figure 3. As most literature (e.g., Fenton and Pfleeger, 1997 and Basili, 1995a, b) agrees that *measurement* has to be done to assure that quality of each object of software production is of the requested level the framework can be completed with the "metric" element (see also ISO-9126, 1999). This is an important item "telling something" about the quality of the objects. This way, the quality framework changed to the one presented in Figure 4, which we called the Quality through Managed Improvement and Measurement (QMIM) framework.

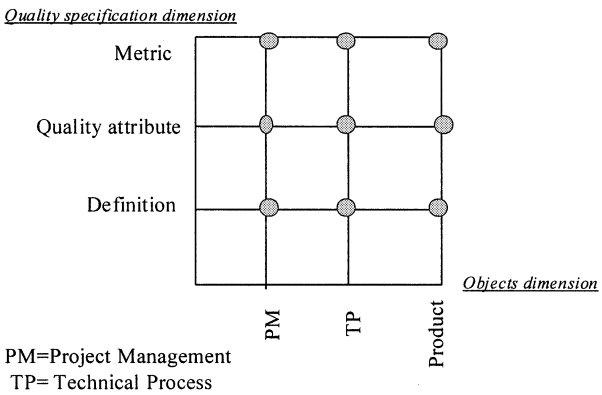

Figure 4. The QMIM framework.

The QMIM framework shows all the elements to be taken into account when dealing with software quality. One can notice that ISO 9001 does not address at all products and metrics, while the grade of detail of the elements "definition" and "quality attribute" can vary according to a company's level of understanding. Based on the framework, IQSOFT identified two possibilities to develop its QMS: either start using metrics or concentrate on product quality. In 1999 the technical director decided on the introduction of metrics. After an analysis of the actual situation (including a study of possible metrics) the decision to improve software estimation and productivity at IQSOFT was taken. Two metric programs were carried out using basically the GQM paradigm (Basili, 1995b). The selected projects were medium sized. The analysis of the obtained data showed that in three cases the effort needed has been underestimated and the projects did not finish in time. The technical director considered the data obtained interesting, although no general conclusions could have been drawn. If we again look at the key factors identified in the previous phases (i.e. our lessons learned) we may note for the starting conditions for the "metric program" project:

- sufficient understanding of the current position;
- *no* clear business case;
- therefore *no* transition of this business case into a set of clear and operational goals;
- a reasonably solid project approach;
- *no* time and effort were deemed necessary for training.

Furthermore in project execution we saw:

- *not much* visible management commitment;
- *some* communication with the staff about the projects;
- *some* active participation by the staff in project execution;
- *insufficient* attention to tailoring the metric approach to the specifics of the IQSOFT situation.

The conditions that enabled the earlier projects to succeed were not met for these projects. This shows probably that IQSOFT was not yet ready to carry out efficiently and effectively metrics programs.

Despite this setback work is continuing. IQSOFT management decided in the summer 2000 to establish a testing team. Working with the most modern testing tools, this activity seems to give good results. Therefore the next step for IQSOFT will probably be a better understanding of products and their quality characteristics.

2. The QMIM reference framework and model

While running the case study described in Chapter 1, a series of lessons was learned. Here we review and structure these findings, as we feel they are applicable in other low-level maturity software organisations, too. We found that:

1. Using a step by step, project based approach helped us to proceed gradually towards an improved QMS,
2. The distinction between project management processes and technical processes enabled us to get a grip on process complexity,
3. Using the simple QMIM-framework helped us in identifying new directions for improvement of the QMS.

Each of these issues will be discussed below.

2.1. A stepwise approach

We feel, specifically based on the results of phases 3 and 4, that a solid project-type approach towards developing and improving a QMS is a viable means of achieving success. In looking back at the occurrences at IQSOFT we could identify a number of factors that facilitated the success of phases 3 and 4 and help to explain the lack of success of phases 1 and 5. We identified as project pre-conditions:

- A solid understanding of the current position (where are we). For this we found the bootstrap assessment very useful but not sufficient. Theoretical knowledge combined with local knowledge were required to make sense of the results;
- The existence of a clear business case (what do we want to achieve). Management as well as staff need to share a clear vision on what needs to be achieved during the next phase;
- The transition of this business case into a set of clear and operational goals (what are we going to do to get there). Visions are useless without a clear and agreed upon understanding of the road to travel;
- A solid project approach (how are we going to do this). This is the requirement for management control and resource allocation;
- Time and effort being spent on training (what do we need to know to do this).

Furthermore, we identified the following conditions that need to be in place during project execution:

- Active, visible management commitment. Quality is a complex issue, often seen by staff to be an add-on to their day-to-day responsibilities. A first requisite to changing this attitude is definite management attention;
- Continuous and explicit communication with the staff about the project from inception to conclusion. This second factor is aimed at the same problem area. If you want to change staff attitude, communication is an essential requirement;
- Active participation by the staff by involvement in project execution, soliciting feedback on intermediate results and modification of the basis of this feedback. Again a factor aimed at staff attitude. Involving staff and taking their input seriously is an important contribution to staff commitment to the project result;

- Adaptation of the QMS to the specific requirements of IQSOFT. Not only because it allows staff input to be taken into account and so gives credence to the previous success factor, but also because due to the complexity of the quality area standard solutions are unlike to 'fit' in the organisation.

The lessons presented above can be categorised into more 'technical' quality issues (what do we want to achieve, how can we achieve it, etc.) and more 'behavioural' quality issues, dealing with staff attitude, motivation, and commitment. We will focus in the remaining of this paper on additional lessons learned in the 'technical' area.

2.2. Dealing with process complexity

In the first phase, one of the problems encountered was the inability to describe development processes in such a way that on the one hand the complexity of software development was represented while on the other hand a means of control was offered. No single process description was seen to provide adequate coverage. In phase 3 a solution to this problem was offered by the decision to separate project management activities from the technical ones. The rationale behind this was is realisation that project management activities are more stable than the technical ones, and can provide a common framework for all projects within the company. The validity of this approach was confirmed in phase 4, when as a part of the ISO-9000 certification effort IQSOFT succeeded in identifying a limited number of technical processes that were accepted by the staff as representing the actual processes at IQSOFT. We assume that this experience is also valid for other organisations and suggest that they:

- understand the basic concepts of a project management model and develop a company specific project management model;
- use this general project management approach as a starting point for the identification of required technical processes;
- develop models for these technical processes, based on the requirements of the specific company.

2.3. The QMIM-framework

One basic issue in the case study was the construction of the QMIM framework, as presented in Figure 4. One of the issues surfacing from this case study was that of the complexity of the quality issue. This means that deciding what to achieve and how to achieve it is no trivial matter. The QMIM framework is a simple support tool that provides an overview over this complexity.

The basic elements of this framework are: project management, technical processes and products. Any organisation starting to do quality improvement will have to take these elements into account. The definitions of the elements have to be set. Understanding that the quality of the elements is characterised by their quality

attributes, which have to be measured using appropriate metrics, is extremely important. In this way, the QMIM framework provides an abstract blueprint for a QMS.

Using this blueprint does not require that all its elements are in place from the beginning: it only gives its user the understanding of the important elements of a software quality management system, enables a description of the current QMS as it exists in the company and can serve as a basis for QMS improvement decisions.

This understanding also provides a structured view on the approaches existing in literature. The user will be able to place the various models, standards, approaches found into the QMIM framework, being able to see the issues addressed by each approach, and thus selecting more easily the one which best fits their own needs.

The QMIM reference framework can be used in the following way to guide the step-wise improvement process as advocated above:

Step 1. Identify the actual state of the company's QMS regarding concepts, definitions, procedures, and support (templates, tools etc.). The result of this identification step will be a company's version I of QMS. Its degree of completeness will reflect the company's actual level of maturity.

Step 2. The QMS version I can be compared with the QMIM framework, a high level reference. This comparison will show the strengths and weaknesses of the actual situation and will result in noticing the missing elements. On the basis of the comparison an additional analysis can be done for a next improvement step. Type, ambition level and direction of the proposed change will need to take into account the maturity level of the company and the ability and readiness of staff as well as the body of knowledge, described in literature. The result will be a quality system version $I+1$.

Steps 1 and 2 can now be repeated. QMS version $I+1$ will be compared again to the reference provided by QMIM, and a decision is made and implemented resulting in a quality system (version $I+2$) that is better suited to the needs of the organisation. Figure 5 represents this continuous process of quality improvement.

It is important to notice that the analysis may suggest several possible directions of growth/improvement. The choice to take cannot be found in a cookbook. It needs to be made based on local, situational considerations. However, we suggest that software companies situated between levels 1 and 4 of CMM should think about the following basic activities in order to deal with quality management issues:

- define project management;
- define technical processes;
- define products;
- define supporting metrics.

Notice that we did not give sequence numbers to the four basic activities mentioned before, suggesting by this fact that the activities can be performed in any order. However, our experience has shown that performing them in the sequence presented (defining project management → defining technical processes → defining products → defining metrics) works well in a low maturity level software company.

Looking to the reference framework suggested by QMIM, the organisation is able to understand the place and the interconnection of all elements that are important

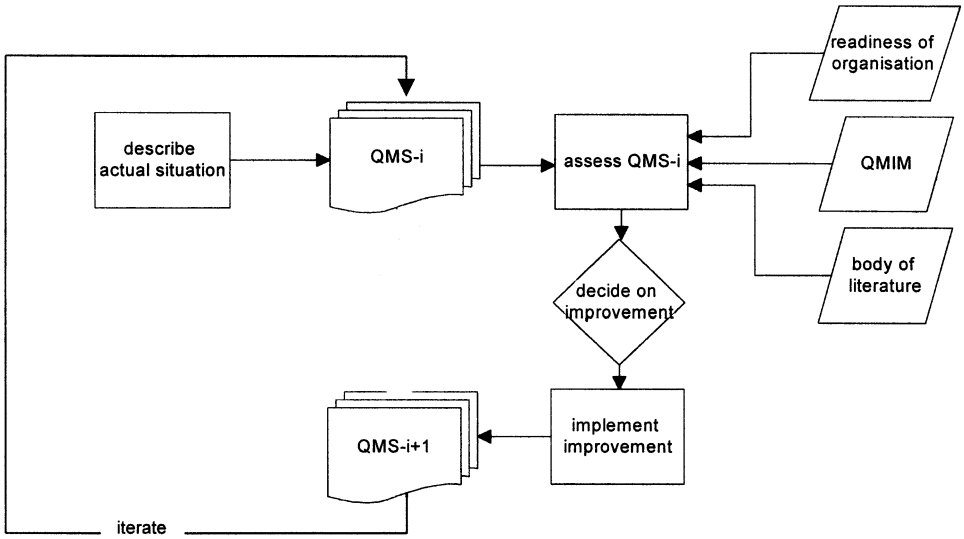

Figure 5. The way of using QMIM in different organizations.

to deal with quality in a complete, unified and balanced way. Using this framework, the company can choose its own direction of development, depending on situational aspects such as maturity, specific business goals at a certain moment in time, business policy.

3. Final remarks

In this paper we described a longitudinal case study regarding quality management issues in a specific Hungarian company, IQSOFT. As we have shown, the way towards a complete and consistent Quality Management System for a software company is a long lasting and difficult journey. Those people, who believe that such a QMS can be in place within a short period of time, are wishful thinkers. Introducing a QMS can only be done step-by-step, consolidating each time the achieved results and continuously supporting and motivating the people involved. As we have demonstrated the commitment of all people within a company is of the utmost importance, ranging from top management to all employees on "the floor." Introducing a QMS is in that sense mainly a matter of changing the way of thinking and the way of doing. This is not a pure rational process but mainly an organisational learning process.

As a result from our longitudinal study we believe that there are a number of useful guidelines for those organisations that are just in the beginning of this type of exercise. In the last chapter we were presenting these guidelines in short in the hope that these guidelines may be helpful for companies, striving at a higher quality level of their software activities.

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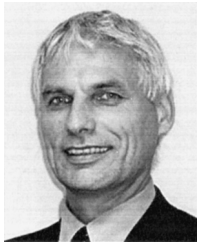

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