

Application of ISO/IEC 15504 in Very Small Enterprises

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Abstract. This paper presents the experience of application of the ISO/IEC 15504 standard in eight software companies. Firstly, the objectives, the participants and the work plan are exposed. Secondly, the implementation of the project activities and its results are summarized. And finally, the cost of the implementation is detailed. The project which has allowed this improvement effort in these organizations has been named “QuaSAR II” and represents the continuance of the “QuaSAR” project, a software process improvement initiative started in 2002 in the Balearic Islands.

1 Introduction

The importance of tourism in the Balearic Islands has promoted the proliferation of small software companies devoted to the development of software for the tourism sector in particular. With the aim of increasing the competence of the products they offer and become an international reference in IT-Tourism, these companies have been grouped together to form a cluster named turisTEC¹, an association of software companies whose main goal is the promotion of the sector.

For turisTEC the transformation of the experience that local companies have in the development of software applications for the tourism sector into a transferable knowledge for any tourism organization in any part of the world requires a continuous improvement effort. As a response to this need, in 2006 some of the turisTEC companies decided to initiate a software improvement programme and they chose ISO/IEC 15504 [1-4] as the reference standard for process improvement. This selection was in great part encouraged by the successful results of the QuaSAR project, an improvement initiative started in 2002 and led by our research group.

In this article we present this software process improvement project which has been running until today. At the present time already eight companies have decided to participate in different process assessment and improvement programmes according to ISO/IEC 15504. Moreover, with the development of the Pathfinder, the new ISO/IEC 15504 certification model [5], interest in this type of initiatives is expected to be considerably increased.

¹ <http://www.turistec.org>

2 The Origins of QuaSAR

Software process improvement is one of the main areas of interest of MiProSoft (Milla de Processos de Software)², our research group. MiProSoft's members started working with ISO/IEC 15504 already in 2000, when the different parts of the standard were only released as technical reports. At that time, one of the challenges of MiProSoft was to promote the best practices proposed by this standard and make them known to the software companies of our environment.

Although then some small software companies in the Balearic Islands had shown their interest in the improvement of the quality of their processes, the attainment of a certification from a reputable entity was a priority for them in order to decide the quality standard to implement. Consequently, the ISO 9001 standard [6] was chosen as the reference standard since this model provided good practices for the implementation of a quality management system and, moreover, a certification against this model was also possible.

Therefore, after considering the interest that software companies had for the implementation of a quality management system according to ISO 9001, we decided to create a project with a dual objective. On the one hand, one of our objectives was to support companies in the implementation of the ISO 9001 standard, as well as in the attainment of the certificate. On the other hand, our second objective was the assessment of the software life cycle processes according to SPICE. This second objective would allow us to analyse the situation in some software companies in our community and also encourage these companies to implement the best practices suggested by the standard.

An important task performed at the beginning of the project consisted on analysing both standards to establish a correspondence between the requirements proposed by ISO 9001 and the software lifecycle processes identified in Part 5 of ISO/IEC 15504 [7]. By performing this analysis it was possible to conclude that an improvement of the software processes according to SPICE would facilitate the implementation of a quality management system according to ISO 9001 [8]. The second important task performed within this project was the definition of a method for the simultaneous implementation of both standards [9]. This method was the one applied to small software companies during the QuaSAR project.

In our opinion the most significant benefit of QuaSAR is that it made SPICE best practices known among a group of small software companies in the Balearic Islands. It was undoubtedly a successful experience for both, the companies and the research group. On the one hand, QuaSAR was the perfect opportunity for eight software small companies to achieve their improvement objectives [10]. As a result of the project, companies improved some of their processes, could identify and plan future improvements and were awarded with the ISO 9001:2000 certificate. On the other hand, thanks to QuaSAR, MiProSoft could apply the results of their investments, improve these results and adapt them to the reality of small companies.

After nearly 10 years of working continuously in the same direction, nowadays the interest that companies show in the implementation of ISO/IEC 15504 still continues alive. The excellent results of this first initiative motivated other companies to participate in a new improvement programme presented in the following section.

² <http://miprosoft.uib.es/en/index.php>

3 QuaSAR II Planning

Since the Information Society and IT companies were identified as key elements for economic progress and productivity improvement, governments in developed countries have been paying special attention to this new dimension of socioeconomic growth. With this intention different strategies or action plans determining the objectives and the necessary resources have been developed. Following this line, Plan Avanza 2006-2010 is the initiative of the Spanish Government to place Spain in a leading position within the Information Society.

Plan Avanza has a structure based on five areas. In particular, the Competitiveness and Innovation area defines measures for the development of the IT sector in Spain and the adoption of technological solutions for SMEs contributing to the success of an economical growth model based on an increment of the companies' competence and productivity.

Within this public aid framework, and more concretely within the action lines for the modernization of the IT sector (SMEs), companies from the Balearic Islands decided to lead their efforts to the attainment of a software certification. In 2007 two companies from turisTEC participated in Plan Avanza and in 2008 other six companies decided to join. The result was the creation of the QuaSAR II project.

3.1 Objectives

The main objective of QuaSAR II was "the improvement of the software processes in the participant companies following the best practices recommended by the international standard ISO/IEC 15504 (SPICE)". More specifically, the goals of the project were:

- To create synergies among software companies to share and spread the knowledge and experiences gained through the project. This was one of the most ambitious aspects of the project since it required a cultural change in a group of small companies towards a collaborative association independently of the individual benefits of each company.
- To constitute a technological excellence group of software development companies.
- To spread the project results to sensitize and incentivize other small companies and institutions to join and participate in future software process improvement programmes.

The specific goals of the companies were the following:

- To improve their products through the improvement of the capability of their processes.
- To be prepared to manage ambitious projects supported by well-defined processes.
- To improve their productivity reaching quality standards with international acknowledgment. As a result of this improvement, companies would benefit from a technological innovation, increasing their visibility as an important competitive advantage for both facilitate partner's collaboration and improve their position into the Spanish and European IT sectors.

3.2 Participants

Collaboration among all the QuaSAR II participants was an important requirement to guarantee the achievement of the project objectives and the efficient solution of possible problems both common and particular. To assure this collaborative climate the managerial structure that supported the project was the one detailed in Figure 1.

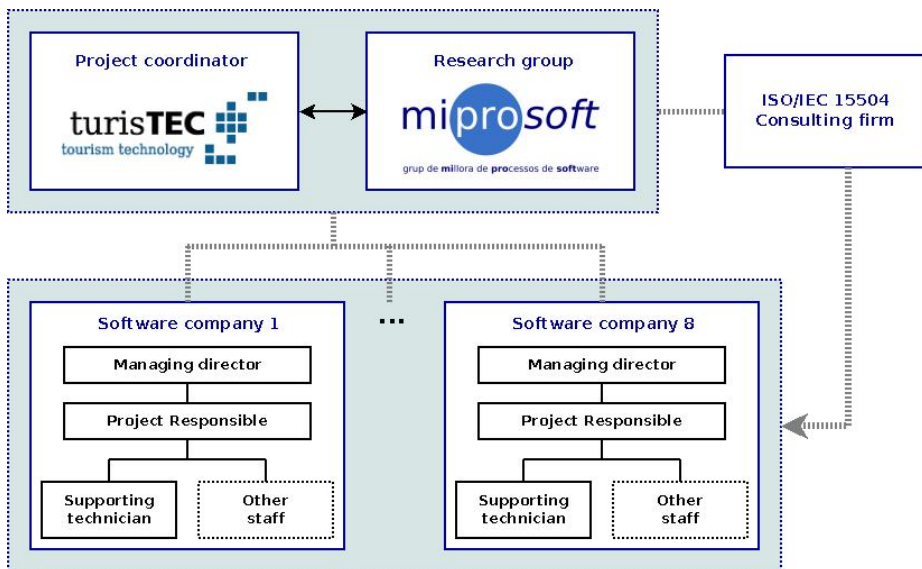


Fig. 1. QuaSAR II participants

Project coordinator

TurisTEC was the coordinating entity of the project, acting as global coordinator and responsible for the project performance. Its main tasks were to facilitate the relation among the project participants and present to the Spanish Government the necessary documentation to justify the performance of the project. It also performed tasks for selecting providers, as well as managing and controlling the project.

Two people from turisTEC were involved in the project: the director of the cluster and a person supporting administrative tasks and communication among all project participants.

Research group

One of the objectives of MiProSoft is the dissemination of the quality culture to companies of the IT sector through product, process and service improvement.

This research group participated in the project by performing training tasks and also supporting different actions to allow the participants to gain the benefits of a grouped action. Three members of the group took part in the project; all of them are authors of this paper.

Software companies

Eight small IT companies whose main activity was software development became involved in QuaSAR II. Table 1 characterizes these companies.

Each one of these participants created an internal improvement team dedicated to the project. These teams were composed of a project responsible and a supporting technician. In some of the companies other staff also participated in the project by performing specific tasks.

In [11] the experience and the results of the improvement programme of one specific QuaSAR II participant are presented.

Table 1. Software companies' profile

Company	Seniority (in years)	Number of employees	Annual turnover	Quality initiatives
C1	9	125	---	2003: ISO 9001:2000 2005: EFQM 2007: ISO 14001:2004
C2	11	---	---	---
C3	16	100	5.265.418 €	2003: ISO 9001:2000
C4	5	10	573.549 €	---
C5	5	35	835.825 €	---
C6	1	6	---	---
C7	4	3	91.172 €	---
C8	4	12	585.145 €	---

Consulting firm

The initial diagnosis and assessment tasks in each company were performed by a consulting firm. The consulting firm also defined an improvement plan and supported the implementation of the improvements in each company in particular.

The selected consulting firm was a Spanish company created in 2001 which provides consultancy services in Software Engineering. Two ISO/IEC 15504 competent assessors from this company participated in QuaSAR II.

3.3 Work Plan

At the beginning of the project a work plan was produced with the aim of assuring the quality of the results, as well as its technical, economical and financial viability. This work plan had to consider the different participants to develop an organizational structure able to solve common problems that could affect the group of companies and also to promote cooperation among them.

Table 2 summarizes the different tasks performed throughout the project by each software company.

Finally, table 3 summarizes the different tasks performed by the other QuaSAR II participants: the coordinating entity, the research group and the consulting firm.

Table 2. Tasks performed by each software company

Coordinated tasks	Participation in grouped actions: training sessions and workshops.
	Participation in monitoring meetings for project coordination.
Individual tasks	Definition the project team. Assignment of roles and responsibilities to each member.
	Preparation of the diagnostic assessment. Establishment of the logistics with the necessary resources. Provision of information about the company projects to the assessor's team for the selection of the projects to be assessed. Assurance of people availability to agree the assessment agenda.
	Participation in the improvement plan. Preparation of a detailed plan and implementation of the identified improvement actions in the company's projects.
	Participation in the second and final assessment.

Table 3. Tasks by participant

Participant	Tasks
Coordinating entity: turisTEC	Serving as representative and mediator among companies and other entities participating in the project.
	Watching out for the good performance of the project.
	Assessment of participants in any aspect of the project and solve possible incidents.
	Supporting the planning, monitoring and control of the project. Validation of the progress of the project.
	Coordination of the different actions to perform among participants.
	Preparation and coordination of the logistics of different project events: training activities, seminars, workshops and project meetings.
	Acting as "spreading engine" of the best practices among all the companies of the cluster.
Research group: MiProSoft	Planning and monitoring the technical progress of the project.
	Performing joint training tasks among all the software companies.
	Organization of workshops for the interchange of ideas to facilitate collaboration among participants.
	Preparation of a final report summarizing the project global results, strengths and weaknesses.
	Spreading the project performance in different events: conferences, workshops, forums, etc.

Table 3. (continued)

Consulting firm	Performing the diagnostic assessment according to the process assessment model provided in ISO/IEC 15504-5 in each one of the software companies.
	Establishment of an improvement plan based on the weaknesses identified in the diagnostic assessment.
	Supporting the identified improvement actions.
	Performing intermediate assessments to control implementation of the improvements and to correct possible deviations of the improvement plan.
	Performing a final assessment to check the correct implementation of the improvements in all the projects of each company and determine if the company was prepared for a certification assessment.

4 QuaSAR II Execution

In this section the different activities performed during the QuaSAR II project are detailed.

4.1 Diagnostic Assessment

In 2007, when QuaSAR II started, ISO/IEC 15504 Part 7, also named Pathfinder [5], was not still released as international standard. This part provides a certification scheme to asses the maturity of an organization.

In order to identify the processes to improve, companies mainly considered their organizational objectives. In addition, they also took care about the processes for a maturity level 2 identified in the Pathfinder draft. The main reason of also considering the processes of Pathfinder was that companies wanted to be prepared for a future formal certification against the standard.

The consulting firm supported each company in the selection of suitable processes based on their needs. Table 4 presents the processes selected by each one of the companies.

As a result of the diagnostic assessment several process strengths and weaknesses were recognized. Table 5 summarizes some of the identified weaknesses. These were considered to define a set of corrective actions. Finally a detailed improvement proposal was planned for each process to improve in each company.

4.2 Implementation of the Improvement Actions

In each company some improvement actions aimed to correct deviations from the standard regarding the values obtained for the performance and the capability indicators of the assessed processes were performed. Each company prepared its own improvement plan which was individually executed. At this point, manager and staff commitment

and support were critical in order to arrange the necessary internal resources for the improvement actions, as well as to define the work chronogram. In [11] the implementation of the improvement actions in one of the eight companies is detailed.

During the improvement implementation period both the consulting firm and MiProSoft supported companies by performing different activities. Table 6 summarizes the training needs that software companies requested to MiProSoft.

Table 4. Selected processes

Process	Description	C1	C2	C3	C4	C5	C6	C7	C8
ENG.1	Requirements elicitation	X	X	X	X	X	X	X	X
ENG.4	Software requirements analysis	X	X	X	X	X	X	X	X
ENG.5	Software design	X	X	X	X	X	X	X	X
ENG.6	Software construction	X	X	X	X	X	X	X	X
ENG.7	Software integration	X	X	X	X	X	X	X	X
ENG.8	Software testing	X	X	X	X	X	X	X	X
ENG.11	Software installation	X	X	X	X	X			
ENG.12	Software and system maintenance	X	X	X	X	X	X		X
SUP.1	Quality assurance		X						X
SUP.2	Verification	X	X						
SUP.4	Joint review	X	X	X	X	X		X	X
SUP.7	Documentation	X	X	X	X				
SUP.8	Configuration management	X	X	X	X	X	X	X	X
SUP.9	Problem resolution management	X	X	X		X	X		X
SUP.10	Change request management	X	X	X		X			X
MAN.3	Project management	X	X	X	X	X	X	X	X
MAN.5	Risk management	X							
SPL.1	Supplier tendering				X				X
SPL.2	Product release	X	X	X	X	X	X	X	X
ACQ.1	Acquisition preparation						X		X
ACQ.3	Contract agreement		X				X		X
ACQ.4	Supplier monitoring		X				X		X
ACQ.5	Customer acceptance		X				X		X

Besides the processes identified in table 6, nearly all the companies were interested in receiving training in ISO/IEC 15504 capability level 2.

Unfortunately it was not possible to satisfy the exact requests for each one of the companies. Therefore after analyzing all the requests as a whole the final MiProSoft training programme was as table 7 shows.

Table 5. Summary of weaknesses identified in the diagnostic assessment

Weaknesses
The effort required for the different tasks in a project was not always planned.
Explicit evidence of plan adjustment when deviation occurred was missed.
The number of working hours per person and activity was only globally monitored per project.
Process management in projects was not usually performed individually.
Knowledge and necessary skills to perform each process were not explicitly defined.
The process resultant products were not independently managed.
User requirements were not always explicitly defined.
Software requirements were not defined as the solution to the customer needs.
Evidence of meetings among the members of the development team and the decisions taken were not registered.
The security of operational products seemed to be sometimes compromising. Versions were not included in the baseline database.

Table 6. Training request

Process	Description	Number of requests
ENG.1	Requirements elicitation	5
ENG.4	Software requirements analysis	2
ENG.5 – ENG.11	Engineering processes	1
ENG.12	Software and system maintenance	5
SUP.8	Configuration management	8
SUP.9	Problem resolution management	5
SUP.10	Change request management	4
MAN.3	Project management	6
MAN.5	Risk management	7
REU.1 – REU.3	Reuse Processes	3
SPL.1	Supplier tendering	1

The consulting firm participated in the different improvement phases. Firstly, previously to the implementation phase, it offered support to each company in the elaboration of the implementation plan. Secondly, it performed some assessments in order to check if processes to be improved were aligned with the identified improvement objectives and with the processes of the reference model.

Finally, a final assessment was performed to determine the capability level of each implemented process. The global evidences and results were reported. In the final report, besides the processes profile, the capability level of the processes, the identified strengths and weaknesses, as well as the improvement actions for each process were documented.

Table 7. Accorded training programme

Session	Contents proposal
First	Capability level 2 <ul style="list-style-type: none"> • PA.2.1 Performance management attribute • PA.2.2 Work product management attribute • Capability level 2 in ENG.1
Second	Support processes for capability level 2 <ul style="list-style-type: none"> • MAN.3 Project management • SUP.8 Configuration management
Third	<ul style="list-style-type: none"> • MAN.5 Risk management • SUP.9 Problem resolution management
Fourth	<ul style="list-style-type: none"> • SUP.10 Change request management • ENG.12 Software and system maintenance

5 QuaSAR II Company's Costs

In this section the effort and total costs of the project execution in each company are shown. It is important to note that these are approximate costs since although external costs were common for all the companies, internal costs varied depending on each company in particular.

These costs are the average value of the real costs in each software company. Table 8 shows the average external costs for a software company.

Table 8. External costs

	Project phase	Activity	Hours	Cost		
Consulting firm	Diagnostic assessment	Initial meetings	8 h	640€	5.440€	
		Initial assessment plan	12 h	960€		
		Initial assessment	32 h	2.560€		
		Initial assessment report	16 h	1.280€		
	Process improvement support	Improvement actions plan	24 h	1.920€	6.400€	
		Intermediate assessments	48 h	3.840€		
		Improvement actions support	8 h	640€		
	Final assessment	Final assessment plan	12 h	960€	4.800€	
		Final assessment	32 h	2.560€		
		Final assessment report	16 h	1.280€		
	Total External Costs:			208 h	16.640€	

Table 9 shows the average internal costs (personnel costs) for a software company.

Table 9. Internal costs

Internal costs		1st year	2nd year	Total
Personnel costs	Project responsible (35 €/h)	2.800€ (80 h)	2.800€ (80 h)	5.600€
	Technical personnel (30 €/h)	2.400€ (80 h)	21.600€ (720 h)	24.000€
Total internal costs:		5.200€	24.400€	29.600€

6 Conclusions

The main goal of the QuaSAR II project was to give support to eight software companies in the improvement of their software processes. The project was created as a strategic action to produce the structural change necessary for the IT companies from the Balearic Islands to afford competency challenges in a near future.

The impact of the project results had an important transcendence for the software companies:

- Improvement of the companies' position and productivity.
- Formation of software improvement teams. Teams composed of at least three people with specific knowledge in software processes were created to assure the continuity of this improvement initiative once the project would have ended.

Other important results of the QuaSAR II project have been the following:

- Incentivizing the IT and software development sectors in the Balearic Islands.
- Encouraging collaboration among small companies and R&D corporations promoting technological transference.
- Connection of companies to jointly afford forthcoming ambitious collaborative actions promoted by the Spanish Plan Nacional de I+D.
- Domino effect which has encouraged other small companies of the sector to participate in similar programmes.

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References

- [1] ISO/IEC 15504-1:2004. Information technology – Process assessment – Part 1: Concepts and vocabulary. International Organization for Standardization (2004)
- [2] ISO/IEC 15504-2:2003. Information technology – Process assessment – Part 2: Performing an assessment. International Organization for Standardization (2003)
- [3] ISO/IEC 15504-3:2004. Information technology – Process Assessment – Part 3: Guidance on performing an assessment (2004)

- [4] ISO/IEC 15504-4:2007. Information technology – Process Assessment – Part 4: Guidance on use for process improvement and process capability determination (2007)
- [5] ISO/IEC TR 15504-7: 2008 . Information technology – Process Assessment – Part 7: Assessment of organizational maturity. International Organization for Standardization (2008)
- [6] UNE-EN ISO 9001:2000. Sistemas de gestión de la calidad, Requisitos. AENOR 2000 (2000)
- [7] ISO/IEC 15504-5:2006. Information technology – Process Assessment – Part 5: An exemplar Process Assessment Model. International Organization for Standardization (2006)
- [8] Amengual, E., Mas, A.: A new method of ISO/IEC TR 15504 and ISO 9001:2000 simultaneous application on software SMEs. In: Proceedings of the Joint ESA – 3rd International SPICE Conference on Process Assessment and Improvement, March 2003, pp. 87–92 (2003)
- [9] Mas, A., Amengual, E.: A method for the implementation of a quality management system in software SMEs. In: Software Quality Management XII. New Approaches to Software Quality. The British Computer Society (2004)
- [10] Amengual, E., Mas, A.: Software Process Improvement in Small Companies: An Experience. In: Industrial Proceedings of the European Software Process Improvement Conference, September 2007, pp. 11.11–11.17 (2007)
- [11] Mas, A., Fluxà, B., Amengual, E.: Lessons learned from an ISO/IEC 15504 SPI Programme in a Company. In: Industrial Proceedings of the European Software Process Improvement Conference, September 2009, pp. 4.13–4.18 (2009)