Software Process Improvement Case Study

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Ricerca S.r.l. Test planning and application

Overview - ***AD Ricerca S.r.l.*** *mainly operates in the sectors of management software, Electronic Document Management and Workflow Management.*

The Company has participated in the SPIRE initiative aware of the fact that it does not yet have an engineering approach to the development of software, especially as far as the control of the various phases of the life cycle and the carrying out of testing are concerned. For this reason, the company started an improvement project directly co-ordinated by the company's Managing Director and Technical Director ***Ing. Roberto Gabbi.*** *His objective was the introduction of a methodology and procedure for the planning, carrying out and recording of the product validation tests.*

The procedure was placed in a ***life-cycle model*** *for software products, defined on the basis of the requirements of regulation* ***UNI EN ISO 9001*** *concerning the control of planning.*

The application phase of the project, which for obvious reasons of time constraints concerned a limited sample of projects, led to estimated savings of up to 50% of costs related to corrective operations on the released product.

Alongside this result, which in any case was positive, it should be added that the management of the company became aware, during the course of the project, that bringing other processes into line with the requirements of the ISO 9001 regulation might be an objective to achieve by the end of 1998.

Thanks to a substantial additional investment of internal resources and to the consultative support of the same mentor selected for the improvement project, the support procedures for the life-cycle, customer assistance and quality management were also aligned with the requirements of the ISO 9001 standard. In a relatively short period, documented procedures were introduced and a quality manual was written. At the same time as the SPIRE project was being concluded an accredited Certification Agency was judging the quality system of AD Ricerca S.r.l. as conforming to the requirements of the UNI EN ISO 9001 regulation.

The benefits the company achieved from its participation in the SPIRE initiative could also be defined as far superior to the initial expectations.

The Organisation and its Environment

AD Ricerca S.r.l. can trace its origins to a company called Advanced Data, founded in 1985 with the objective of support for a major Italian industrial group. In 1993, it became an autonomous company whose production, while initially orientated mainly to applications within mainframe systems for a selected group of clients, gradually diversified both from the point of view of information technology applications and of the extension of types of users of its products.

The technical staff includes around fifteen software development and assistance personnel, with a high level of training and specialisation. Their technical competence allows them to respond to a multitude of application requirements in the fields of management procedures, EDM (Electronic Document Management) and Workflow management. The Company operates throughout Italy and can offer personalised information technology solutions for a wide variety of clients: banks, service companies, manufacturing companies, food companies and hotel chains.

Software production is divided between the following areas:

- Management procedures within the MVS mainframe system for the local banking market;
- Management applications within the UNIX system on HP minicomputers;
- Client / Server applications of EDM and of Workflow Management on FileNET and LOTUS technologies

The service which AD Ricerca S.r.l. offers to the client, whatever the sector of application, is always made up of a sum of diverse elements:

- Standard software products or rather application software developed in standard systems;
- Teaching, start up, training and maintenance services related to the product provided to the client;
- Updating services concerning the product supplied and the creation of personalised products at client's request.

The average annual turnover of the company, as far as software supply is concerned, is around Lit. 3 billion.

Within the company, special attention is given to technological evolution in order to supply products that are constantly in line with the most advanced level of the state of the art.

Furthermore, the company has always been aware of the importance of quality in the software development process, above all in consideration of the diversification of its products and its clients.

From this point of view and taking into consideration the competence gained in the sector of Electronic Document Management, several information technology supports have been introduced composed of databases developed with FileNET and LOTUS technologies for the control and recording of customer assistance. This is seen not only as the correction of software errors, but also as the organised management of all the requirements expressed by the customer with reference to improvements in the products already released.

Starting point

The management of AD Ricerca S.r.l. used the opportunity offered by its participation in the SPIRE initiative to tackle a crucial problem: **the increase in time and costs (up to 25% compared to the total cost of development) due to corrections to the software product following release.**

The management has always seen the problem as being correlated to the absence of a reference model for the software's life cycle, which has the following requirements:

- The possibility of being applied to the various types of product of the company;
- The clear definition of product release dates following the test.

The assessment, carried out during the initial phase of the design project by the **mentor** selected by the company, confirmed that the weak points of the development project indeed concerned the **life-cycle** model in general and the **testing** in particular.
The profile of the company, on the basis of the assessment, resulted in brief as the following:

- The weakness of certain processes related to the life-cycle and to the support activity;
- A high level of consolidation of the processes aimed at the requirements of the customer, both in the contractual phase and the area of assistance services;
- A high level of awareness by the technical personnel of the problem of improvement.

In the light of the results of the assessment, the management's attention was concentrated on the importance of introducing a life-cycle model and a testing method, also with the perspective of gradually reaching a process standard conforming with the requirements of the ISO 9001 regulation.

Following the assessment, the improvement goals were also defined with greater clarity:

- The spreading throughout the company of a culture of software quality control, achievable through tests
- Efficient reporting of the test and its use, also in a *reuse* perspective of the same tests
- Minimisation of the adjustments during the phase following the product release.
- Improvement in the medium/long-term of the cost/ benefit relationship of the product.

The Improvement Project

The general approach

The planning of the improvement project was based on these elements:

- Allocation of the testing activity within a predefined life cycle
- Conformity of the life-cycle to the ISO 9001 standard
- Use of electronic support for the documentation, coherent with the tradition and technical competence of the company
- Training for all the technical personnel

The phases of the project

- Definition of the procedure
- Personnel training
- Application

The organisation

The company's management took part directly in the improvement project, which was co-ordinated by the Managing Director and Technical Director **Ing. Roberto Gabbi** and saw the participation of the company's entire technical staff.
The Management also sought the consultation of the same mentor for the set up of the life-cycle, the definition of the testing procedure and the personnel training.

Personnel training

During the design project, the management paid great attention to the training of the technical personnel.

It was considered crucial to introduce among the staff an engineering mentality in the planning and creation of the software test, an activity up to then only entrusted to the ability and responsibility of the developer at the end of the coding phase.

The training given to the personnel, more in order to spread a method already standardised in the area of software engineering, was above all focused on the following concept: *the efforts and abilities of the designer are aimed at the planning of the test before its execution* in other terms, the training phase had the goal of: *clearly stating that the definition of the tests is in all senses a phase of the software design.*

The test procedure

The life-cycle

- Functional analysis
- Software planning
- Planning of validation tests
- Development
- Validation test
- Release to the customer

The life-cycle model introduced is the so-called "waterfall" type, which means the carrying out of a new phase following the completion of the previous one.

Particular emphasis was given to a moment of design review, allocated at the end of the functional analysis, which has the aim of clearly defining the requirements of the customer.

The precise and complete definition of requirements, to be carried out with the customer if necessary at the review session, was considered the essential premise for the correct planning, and complete and clear definition of the final test of the product.

The review of the product requirements before the planning phase constitutes a clearly preventative approach in the face of the risks of remakes and corrections to the product, both in the course of work and after its release.

The test method

The approach chosen is as follows:

- Definition of the *test cases* on the basis of the product requirements
- Definition of the *test sequences* to be carried out on the product before release

The test cases are the situations in which the software must indeed be subjected to tests and, in the specific case of validation tests, they regard the use of the product.

The test sequences are lists of test cases organised in such a way as to allow the designer to carry out tests in a complete and optimised manner, starting with well-defined initial product configurations.

The company wished the method to have a general valence, that is not only applicable to validation tests, those having the aim of verifying the conformity of the product to the user's requirements.

In other words, this means that the same approach can also be used in other test phases, not necessarily related to the functionality of the product that is "visible" to the customer (for example module tests and integration tests).

Documentation

To define the test cases and the test lists (*chainlist)* an electronic document support has been used from the beginning. It is composed of a filing system in Lotus Notes.

The same electronic document for test planning was designed to contain the test reports as well.

The documentation was also organised so as to be distributed, thanks to the company's network, to all the technical personnel involved in the development team of a product.

The experimentation

The life-cycle model and the procedure of planning and carrying out of the validation tests were applied, in the final stage of the project, to two projects underway, representing the core sectors of the company's production:

- Management software procedure
- Electronic Document Management

Both projects required, for the planning and execution of the tests, an additional effort equal to around 15% of the total work.

The Results

Despite the greater effort in terms of days/personnel dedicated to the testing, results obtained from the software production, emerging from an estimate made of a relatively short time period, were positive: ***a reduction of 50% was estimated in the costs of product assistance following release.***

As well as this result, which expresses quantitatively the level of achievement of the fundamental objectives of the project, the company reached another target, which at the project's outset certainly did not appear achievable in such a short time: ***the introduction of a quality result system conforming to ISO 9001 following the evaluation by the***

Certification Agency, coinciding with the end of the SPIRE project.

In the light of this result, from the final assessment at the end of the project there appears to be an increase in the qualitative level of many processes. In particular, the following aspects should be highlighted:

- The processes relating to the software life-cycle and to the support activity can generally be allocated at capability level 2;
- The processes relating to the management of software errors and assistance, in any case proving more than consolidated in the initial assessment, can be allocated at capability level 3;
- Due to the existence of a quality system, the processes of *Human Resource Management, Quality Management and Process Definition* are at capability level 1; the recent introduction and application of the quality system in any case leaves ample room for improvement also in the above processes.

Lessons Learned

The benefits to the company of participation in the SPIRE initiative were clearly positive and the results obtained were far greater than initial expectations.
The management of the company is well aware of the factors which contributed to the success:

- Having faced during the SPIRE project a problem such as life-cycle rationalisation which, in the area of quality of software processes, represents the principal element
- The management's commitment to improvement expressed in the considerable additional investment of resources compared to the project budget
- The effective collaboration of all the company's personnel with their technical competence for the achievement of the objective
- The support given by the mentor of the SPIRE project in the evaluation of the level of conformity of processes to the ISO 9001 standard and in the encouragement given to the management to persist in reaching a target which at the beginning seemed far off.
- The production of all the project documentation on electronic support, fully in line with a work method used in the company for years.

Plans for the Future

Well aware of the fact that, as the company president **Dott. Paolo Gabbi** says, "*the certification of the quality system should not be a point of arrival but a point of departure"*, the company intends to follow the road of continuous improvement of the quality of processes.

Specific objectives in this sense, which could constitute areas to tackle in future improvement projects, are:

- To extend the use of the testing method introduced in the project to other "internal" test phases considered crucial in projects of a certain complexity;
- To analyse the level of achievement of the quality objectives through wide use of statistical techniques;
- To improve the method of project management and general management.

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