Software Process Improvement Case Study

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PRIOR
Process improvement on Software Requirements

Overview *- **DELFI S.r.l**. is an information technology consultancy company able to operate in diverse systems, from Mainframe to Mini and Personal Computers, in market sectors such as banking, insurance, trade associations, retailing and public administration.*

The company's principal activity is software development and in this sector Delfi's management has recognised the necessity to pursue the following objectives:

- *To improve the management of software design and maintenance processes*
- *To optimise the employment of internal resources*

Thanks to SPIRE, the systematic application of Software Engineering practices, such as:

- *Adequate collection of customer's needs (requirements)*
- *Correct evaluation of the impact of variations in the requirements*
- *Effective application of Verification and Validation methods*

Without question this demonstrated that:

- *The production and management of project documentation is fundamental for a correct relationship with the customer and for the best possible control of the progress reached in the same project*
- *The application of an experimented method for the management of the software projects should be extended throughout the company.*

As a side effect that cannot be ignored, the introduction for the first time in the company of an analytical measurement of company data is particularly important. This has permitted the quantification in a very precise manner of the benefits obtained from the improvement of the processes involved in software production.

The Organisation and its Environment

In collaboration with the companies in the group it leads, Delfi offers consultancy and information technology services in various sectors of the market. The partnership relationships with major national and internationals companies are a guarantee of reliability and offer the opportunity to meet the most important challenges from the technological point of view.

Delfi's growth has been made possible thanks to the constant research and experimentation of new market areas, with great attention paid to specific areas (e.g. PT – POSTEL, the Italian electronic postal service) and to the new technological of the ICT (Internet, Computer Telefony Integration).

In total the Delfi group is composed of around 90 staff (42 for Delfi S.r.l), distributed in various projects, of which around 70 are constantly employed in software development. A significant proportion, around 50%, work on software development projects for major banking groups operating in Italy.

The average duration of these projects is around 1.5 months / employee, 60% of this is related to integration work on existing procedures and the remaining 40% relates to new developments. The workgroups generally consist of a Project head / Analyst and one or two programmers.

In the past, interactions with the customer were limited to informal relations, with mainly verbal communication of software requirements. This practice led to critical situations that may be summarised in the following points:

- major possibility of misunderstandings about specifications
- high number of software recycles, often linked to the lack of clarity of the initial requirements
- difficulty of estimating completion times with consequent project overruns

A brief experience of software process improvement, related to the TAPISTRY project (ESSI Esprit Project N° 24238), led to the introduction in the company of several management practices for the software production process. Following this event, the company management decided it was fundamental to make the company resources aware of the importance of introducing control and improvement methods in the process. With regard to the Tapistry project, analysing the data available for the projects in 1997, it was possible to estimate that the introduction of control methods could bring economic benefits in the order of 10%, thanks to better allocation of resources and shorter completion times.

Starting point

The evaluation by the mentor, during the initial assessment, substantially confirmed the considerations made within the company, highlighting:

- fairly difficult collection and localisation of requirements
- difficulty of making a correct estimate of resource allocation
- lack of a Verification and Validation phase
- lack of structured and standardised documentation
- planning and estimate of risks based on individual's experience.

Furthermore, it was noted that the above problems are closely connected to each other, also with cause-effect relationship. This characteristic suggested that the problem should be tackled in its entirety, concentrating efforts more on the method to be applied than on its sophistication. In other words, it was decided to make simple and effective tools available to support the management of processes in order to achieve the minimum objective of validation of the same.

Consequently, the objectives of the improvement plan were defined:

- the establishment of an effective practice for the efficient management of requirements
- the establishment of practices for the management of variations in requirements
- the localisation of requirements towards the verification and validation phase
- the introduction of basic test procedures to achieve better definition of requirements
- the control of resource allocation for requirements and their variation
- the start of a data collection to build a historical record usable for the estimate of effort in subsequent projects
- the introduction of an electronic support that guarantees the localisation of requirements during the entire software development cycle.

In fact, a database already existed in the company in which project activities were recorded, but it totally lacked a census of requirements. Therefore, this data could not be used as a historical reference for the project to which the data referred.

The numerical verification of the benefits obtained being necessary, various pilot projects were chosen, belonging to the same client and relating to the same procedure. This choice permitted a rough estimate of the complexity of the projects that could allow the comparability of the collected data: in fact, the correct evaluation of benefits obtained is only possible for projects with similar complexity.

The Improvement Project

The application of the improvement plan essentially involved the following aspects:

- the definition of a methodology aimed at engineering the requirement collection phase
- identification and creation of tools for the management of the same
- identification of control indices for process performances
- instruction of the personnel involved in the pilot projects in the use of the methodology and the tools

Methodology

Having identified the critical phase of the projects as being the collection of software requirements, the detailed analysis of the documentation provided by the client as a description of the project becomes of vital importance.

From this the following steps are taken:

- the drawing of the requirements
- the analysis of the requirements
- the definition of the validation procedures

The important aspects of this choice are essentially two:

- to carry out a detailed analysis of the specifications
- to encode and standardise the results of this analysis

One of the weak points highlighted in the management of some projects was the tendency to put off the examination of the problems until the software creation phase. The reason for this practice must be found in the knowledge of the client's environment and procedures, built up over time, with the tendency, therefore, to "trust" one's own experience at the time of evaluation and estimate of realisation time.

In reality, detailed analysis of the requirements showed that often the documentation provided by their client is incomplete and unclear and needs in-depth study. From

this viewpoint, the encoding and localisation of requirements proved to be of great help.

Tools

To support the analysis activities, it was decided to create a tool based on MSOffice instruments.

From this viewpoint, a new SQL Server database was created to manage the requirements, connected to the management of the company orders. This relationship is essential in order to allow reports to be obtained which permit the control of project costs and to correctly evaluate profit margins.

Since time is often a decisive element, the automatic management of requirements was a key factor also in overcoming some remaining resistance on the part of the personnel involved in the project.

The production of document models to be generated during the course of the projects was integrated and brought to conclusion the process of standardisation of the company documentation already begun with the Tapistry project.

Control parameters

In 1997, an electronic loading procedure was introduced in the company. It was made obligatory for all personnel to do this at least once a week. This permitted punctual verification of the hours spent on each project.

Nevertheless, it was considered necessary to clarify several interpretations of the data. For this reason a limited set of metrics was defined aimed at highlighting:

- the profit from an order
- the complexity
- the quality of global planning of the project

From this viewpoint, the application of identified metrics to the pilot projects allowed the validity of the improvement plan to be evaluated directly “in practice”, based on real measures of project time and costs. Up until today, the metrics introduced have confirmed that the methodology applied to comparable projects (level of complexity calculated on the basis of number of requirements) has allowed a better estimate of the activities (quality of planning) and a better allocation of resources: the consequence of this is a benefit also as far as the economic aspect is concerned (level of profit).

Personnel training

One of the aspects that concerned the management and the personnel in charge of the improvement plan was the willingness of the personnel involved to take the new procedures on board.

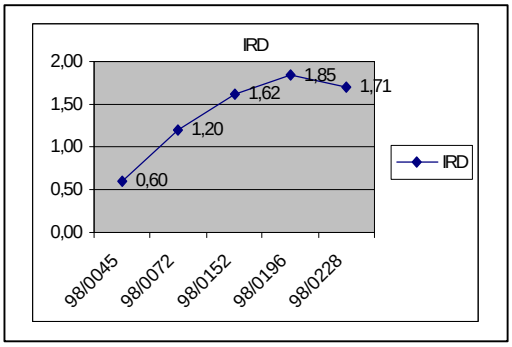
The formalisation of the results of the analysis through the production of documents certainly requires time, and in a situation where time is a critical factor it causes perplexity in whoever experiences it.

In fact, the methodology proposed was received positively by the personnel involved. It was accepted as an opportunity to tackle problems that were in any case felt within the workgroups: *improving the relationship with the customer through better management of the project.*

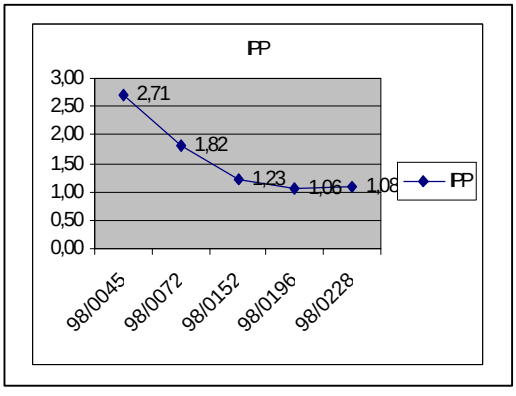
The Results

The examination of the results produced by the use of metrics in the pilot projects highlighted the substantial achievement of the initial objectives.

The progressive application of the methodology showed benefits both in the planning phase and in the profit from the projects. The examination of the SPICE parameters showed a substantial improvement in comparison with the initial assessment as far as the aspects involved in the SPIRE project are concerned. Also the data provided by the metrics showed a substantial improvement as can be seen from the graphs which follow, relating to the IRD – revenues/costs – (now constantly over the value 1, that of parity) and to the IPP – effective time / estimated time - (progressively getting closer to value 1, the correct estimate). The indices are divided by order and displayed chronologically according to order completion.



IRD = Revenues/Costs



IPP = Real Time / Estimated Time

One of the most important aspects of the PRIOR project was certainly the work carried out on the company's data. The production of metrics and the introduction of new control parameters now allow the company to elaborate essential information to support its decisions. Furthermore, access to the data and the documentation has been made easier by using the corporate network Web pages, which were created with specific products such as Front Page.

The impact on the client is not of secondary importance. The question of the identified requirements and the requests for further studies of the initial documentation reduced the necessity for customer contact in the programming phase, giving the client a greater guarantee regarding the final result. Furthermore, the production of standardised documentation gave the client a very positive image of Delfi.

Lessons Learned

The situations tackled during the course of the pilot projects, led to several important considerations.

Investment in quality research produces positive results.
One of the greatest fears when undertaking projects related to quality is usually that the time taken to conclude them will not produce sufficient returns to justify it. This experience demonstrated that, by analysing the problems methodically and proposing practicable solutions, one can achieve significant results.

Sharing the corporate objectives contributes to improvement in results.

The application of the methodology was made easier by the use of tools designed and created in collaboration with other company departments. As a side effect, this method stimulated the development of new ideas in the various departments involved.

Plans for the Future

The results achieved led, as an immediate consequence, to application of the methodology to all the new projects carried out for the customer who collaborated in the pilot phase. Also the other company departments are beginning to be made aware of the problems, especially through the spreading of the applied methodology and the results achieved.

The experience of the SPIRE project has stimulated the awareness of the company towards the search for quality. In a professional environment in continuous and rapid evolution, there are many problems to be faced and processes to be improved. The company is therefore evaluating the opportunity and practicability of further improvement projects to undertake in the future.
As completion and further examination of what was developed during the course of the SPIRE project, the following aspects are under study:

- a criteria for creating versions to apply to standardised documentation
- configuration control for the software produced in the company

As a side effect, there is also the launch of a project for the integration of company data and the progressive transferral of existing databases into the SQL Server system.

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