XXV IASP World Conference 2008

"Small Entrepreneurships Software Enterprises Quality Process Assessment. ParqueSoft Colombia, Real Case"

Flash sessions

Author:
Liliana del S Gómez Arenas (lgomez@parquesoft.com)

ParqueSoft Colombia
Km 7 Autopista Cali-Jamundí, Cali Valle, Colombia

Small Entrepreneurships Software Enterprises Quality Process Assessment: ParqueSoft Colombia, Real Case

Executive Summary

In this paper we first present some of the key issues of ParqueSoft and its software quality assurance strategy. We will also discuss the results of a job done by 18 people in the quality assurance team during 5 years of exploring the referring main processes of the VSE[1] in ParqueSoft. We discovered which development software processes were the strongest, which were the weakest and based on that, we found that the software quality assurance was a better aproach for these entrepeneural small software companies. This job was developed through four rounds of assessments, each one with about 15 ParqueSoft's VSE each time.

Keywords: quality assurance, small software Entrepreneurships

Full Paper Text

The Software Technology Park Foundation, ParqueSoft, is a non-profit organization established in December 1999 with the purpose of creating and developing enterprises providing goods and services to the information technology (IT) market. In an innovative model, ParqueSoft is consolidating Southwestern Colombia's Science, Arts and Software Technology Corridor, integrating 14 Parks located in the following cities: Cali, Popayán, Pasto, Buga, Tuluá, Palmira, Buenaventura, Armenia, Manizales, Ibague, Villavicencio, Medellin, Sincelejo and Pereira.

Throughout these 8 years of operations, ParqueSoft has achieved to create in the region's imagery, in its local and regional governments, in its businessmen, and in its guilds and professional associations, the alternative for a new industry supported by a regional network, revolving upon science and technology platforms and the knowledge of economy.

To date, ParqueSoft and its network of Software Technology Parks houses more than 250 VSE-very small enterprises specialized in the Knowledge Industry, where more than 1000 Software Engineering Professionals specialized in the industry's latest technologies and 200 professionals provide support in administrative and business development processes.

ParqueSoft is the largest Science and IT cluster in Colombia and one of the leading organizations supporting entrepreneurial ventures with a technological base and research projects on technological paradigms applicable to the development of information technology solutions. This leadership has earned national recognition, as attested by the awards received in the year 2003: Exemplary Colombian in the Science and Technology / Institution category and Premio Portafolio

[1] VSE Very Small Entrepreneurships. André Coulter, Graybox Software Testing Methodology-Embedded Software Testing Technique, 18th Digital Avionics Systems Conference Proceedings.

Empresarial in the category of Job Creation, granted by the country's most important economic and business journal.

ParqueSoft's goals for the year 2010 is to develop 400 competitive and productive IT enterprises which will export their software products and services to the international markets, and create 4,000 jobs in an innovative Science and Technology sector contributing to the regional economy by more than US $100 million annually.

In order to fulfill its objectives, ParqueSoft has created an innovative strategic support model, as illustrated in figure 1, that encompasses five macro objectives supported by 16 synergic strategies to promote innovation, enterprise development and R&D.

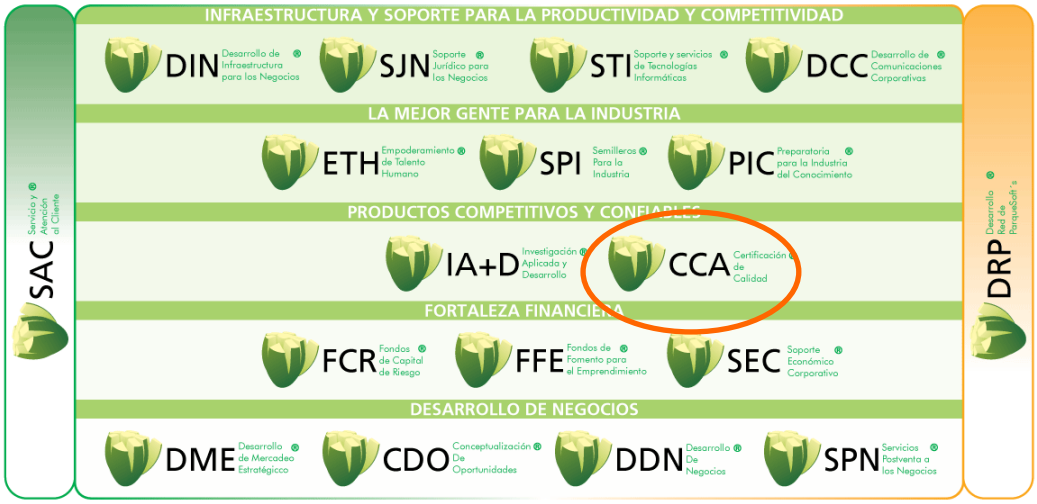

Figure 1- Operative and Strategic ParqueSoft Support Model

The five macro objectives and their corresponding strategies are:

1. **To Provide an Infrastructure for Business Development and Support**,
   To provide to all the companies a logistical support to facilitate their businesses development. Some of them are:
   - Competitive physical and technological infrastructure
   - Technological Support (Telco, Networking, Videoconference, Data Center)
   - Effective Communications (Internet, Intranet, and Media)
   - Intellectual Property and Legal Support

2. **To Develop the Best People in the Industry**,
   So that the sector can be competitive in the world-wide markets requires human talent of world-wide class specialized and certified in specific areas of work, that is why ParqueSoft had developed a program of qualification of the human talent.

3. **To Develop a Financial Strength**,
   To provide support facilitating all the companies their Financial development. Some of them are: Entrepreneurship Promotion Funds, Risk Capital Funds and Savings Funds.

4. **To Support Enterprise Development,**
   Provide support to facilitate all the companies their development. Some of them are: Market Intelligence, Creative Marketing, Business Knowledge, Business Development, Business support and update.

5. **To become more Innovative, Reliable and Competitive Products**, as a result of a Strategy Quality Program, which relates to creating and improving the software process improvements model and quality assurance set of practices for small organizations in ParqueSoft. These practices must be simple, based on common sense, fast and not too expensive to be implemented. A model to really fit VSE needs.

During many years, researchers have been working in models of improvement of software development and quality assurance processes and have released some, most of which like CMMI[2] or ISO Standards have been developed to fulfill large organizations needs. They did not take into consideration the Very Small Enterprises real needs, their differences in structure, motivations and goals, their limited time or resources and other kind of limitations that make them a very special case.

In ParqueSoft, it has been understood that malfunctioning software development process will affects the quality of the resulted software product. As a result, the VSE in ParqueSoft now, after almost 5 year of hard work, pays great attention to improve their processes in order to improve their product quality.

Today, almost 5 years after Software Quality Assurance Strategy initiation in ParqueSoft, based in the obtained results, can be affirmed that the success in the implementation of a culture of quality within the ParqueSoft's VSEs was obtained mainly, because of the coaching and support strategy used: a spiral way, during which, the companies that initiate the process with functional product tests, exercise that are equivalent to the first spiral. It is then repeated in an iterative form until the company learns how to manage it. They identify the root cause of their nonconformities, as well as their weaknesses. They also discover their potential and mainly get to define and to standardize their best engineering practices. This is a fundamental step that leaves them prepared to cross to the second spiral of the quality way: the processes!

The rest of this document presents the results of a great work of these 5 years exploring the referring main processes of the VSE in ParqueSoft to discover which processes are the strongest, which are the weakest. Based on that, we found the software quality assurance to be a better aproach for these entrepeneur small companies. This job was developed by four rounds of assessments with about 15 VSE's of ParqueSoft and it also involved a team of about 18 software engineers.

The First step: Functional Software Testing – Software Reliability

At the beginning of the quality strategy, its main aim was to create a quality culture in ParqueSoft VSE´s. In 2003 and 2004, these VSEs had their major interest in accelerating their product delivery process as well as their software development process; therefore, the software

[2] CMMI dev 1.2 SEI® Carnigie Mellon University

life cycle controls were minimal. In that moment the tester role did not exist formally and every software testing activities were assumed by the developers and even worse, sometimes it was their client's responsibility.

During this period, ParqueSoft did not have a controlled environment for testing execution, we, as a testing group generally used to share resources such as application servers and databases with the software development team. In this context, most of the on-conformities found could have their source in the instability of the software source code. The beginning of the Quality strategy is based on the conformation of a functional testing software laboratory that could initiate operations thanks to the financing that received from the World Bank. Through this initiative, 50 software companies were integrated, 15 testers trained and we also developed and started bus-tracking process with our first version of the GreenWay product, software used for the non-conformities and software requirements tracking.

The quality model initially focused in functional software testing and it was defined to deal with the functional reliability of the 50 software products that then were part of the laboratory. The functional software testing methodology implemented was the result of the multiple and recognized testing approaches research, CMMI, Tickit, TPI, ISO9126. This theoretical research was complemented with the previous definition and implementation experience of the testing, documentation and configuration management process areas in Open System International, one of the largest and well known Colombian software companies.

From his beginning, the development of this software testing methodology had as a main objective to contribute a quantitative, practical and effective strategy to evaluate and analyze the software reliability in ParqueSoft. This strategy had to be independent from the development methodology and technological development platform. The structure of the methodology is based on three stages: ANALYSIS, DESIGN and EXECUTION testing and one cross-sectional feedback activity which helps to follow-up and do measure testing processes.

In its beginning the proposal for the execution part was establish in five iterations of tests cycles, that is to say, systematic executions of the tests requirements that were previously designed. Today, after we had functionally tested 300 software products, we learned to optimized and refine the number of software test iterations to 3.

We also defined as a part of the quality model the team scheme of work using a matrix model. It means a testers become part of the development software team, it is the accompaniment strategy defined with the objective of improving process and adoption of the world class, best quality practices.

The main results obtained in this first step of the quality spiral were:

- Software development team accepted software testing activities as a fundamental and valued part of the development software process, no matter which development paradigm or life-cycle, or even technological platform they were using.
- New customer's satisfaction
- To get back confidence of unsatisfied clients.
- Support from ParqueSoft's assembly to keep going the new quality strategy.

The following table shows the quantitative results of the job done by the quality strategy during 2003-2004 periods

Average number of testers	13
Quantity of Not conformities	15.945
Efforts Inverted	74.304
Impressed companies	68
Software Products Impressed	95
Software Products Certificate	13
Impressed Companies ISO9001	7
Certificate companies ISO9001	5

The Second Step: From Product to Processes – Searching Processes Efficiency

This second step on the consolidated process of the quality strategy covers the period of 2005 and 2006. The VSE population that's included on the second phase of the quality spiral, they are companies whose products have been submitted to tests. The amount of nonconformities found in the software product it is incremental and it's necessary to analyze its origins and identify a prevention strategy.

Finally, the analysis of the products nonconformities, allows visualizing the weaknesses of the VSE's during the software development processes.

During this period ParqueSoft initiates its activity as a software product integrator, to offer its clients solutions in different businesses models such as: Public services or Judicial processes. In this context we see the necessity to improve the text of integration and performance of software products. Again economical support is found for invigoration projects, this time by SENA[3]. These funds allow structuring the performance, load, volume, competition and stress testing lab. Additionally, it supports the development of the Suite's GreenVolution product, a ParqueSoft Quality strategy software platform support.

This second step is a path through we take VSEs to help them identify their chain of value. Identifing the other strategy and support processes of its enterprise exercise; initially the effort is focus on the software development process, going from requirements management to planning and control projects. Then, configuration management, product verification and validation, process of measurement and analysis and so on to understand them very well, to think about them, to improve them and finally to standardize them with base on the reference of international standard ISO9001. Which will gives access to the international certification of their already consolidated system of quality management and its consequent recognition that qualifies them like responsible players for market national or international. This complete process can be long, it varies, a duration average in ParqueSoft is about 24-28 MH, as it is possible to be observed in figure 2, but its speed definitively depends exclusively on the nature and commitment of the VSE at issue. In this program we had given successful support to 145

[3] The national learning service organization

companies to which their software products have been functional tested, also we had obtained the certification of 17 companies under international standard ISO9001.

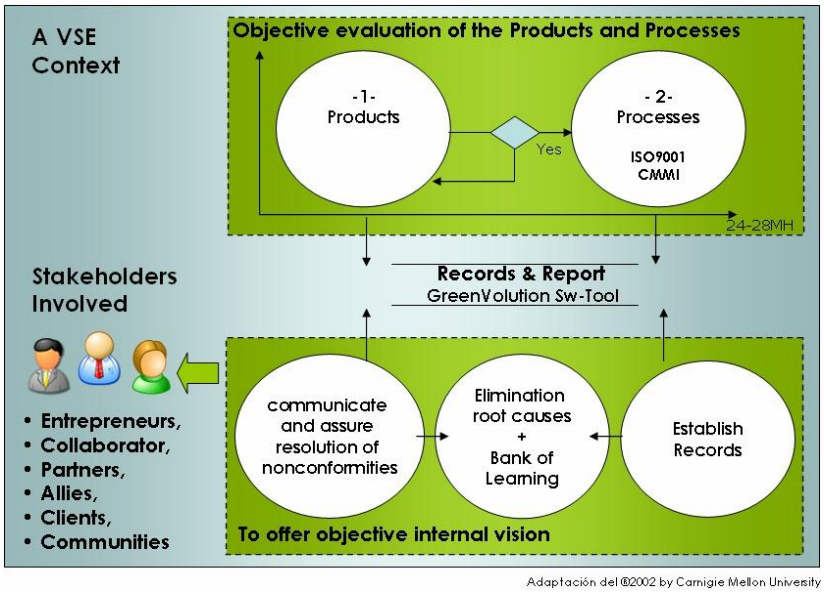

Figure 1- Coaching and Support SQA Path

The pattern of quality in this phase evolves using as referent the international standard ISO 9126. This evolution wide range the strategy, which is transformed from a test focused to a quality focused software. This new focus indexes the six quality dimensions: Functionality, Reliability, Efficiency, Portability, Maintainability and Use Ability. Punctually is worked in the efficiency characteristic, by means of the inclusion of the yield test and the maintainability characteristic, by means the beginning activities of product design revision.
The software test methodology defined from the beginning of the quality strategy, it developed in two elements: the formalization of the design test techniques used to obtain efficiency and dynamism of the execution process of the tests. Indicators were included to test methodology, which permitted the tested object an objective pursuance to the text process and to the software product.

Complementing the quality strategy with the quality process program, when incurring on the strengthening project, this contributed to economical resources for the international ISO 9001 standard implementation in the VSE's. This project was sponsored with the strategic alliance of 3 organizations: *Corporacion Cyga*, ICONTEC[4] and ParqueSoft.

The strategy to begin the quality process program is fundamented in the dynamic interpretation, flexible and innovated of the ISO9001 norm, additionally the team with improving processes strengths initiates it's empowerment in software development processes. The result of this activity is the characterization of the processes of the value chain of a VSE that operates in ParqueSoft. The same way begins the internal auditors' formation in the companies.

The results obtained in this second step of the quality spiral are:

[4] ICONTEC, Colombian government organization.

- The wide coverage acceptance of the quality strategy, it's ParqueSoft's general assembly that makes the decision of generating trust to their clients, committing the delivery of the products under ParqueSoft's software trade accomplish by functional test certificate.
- The acceptance of the software test service as a fundamental and an irreplaceable part of the software development process, recovering confidence of unsatisfied clients and there for support form ParqueSoft's presidency to continue the quality strategy.
- Additionally to that ParqueSoft makes the decision to include the formal process of software test in the Integration projects.

Other strategies such as communications IA+D become a fundamental channel to irradiate the results and improve the procedures of quality practices. The information bulletin board and the web quality tips, make part of a day by day of VSE's community. The following table demonstrates the quantitative results of the job done by the quality strategy in the 2005-2006 period.

Average number of testers	23
Quantity of Not conformities	36.162
Efforts Inverted	191496 HH
Impressed companies	116
Software Products Impressed	221
Software Products Certificate	111
Impressed Companies ISO9001	8
Certificate companies ISO9001	7

The Third Step: Static Tests – CMMI Initiation – The prevention before correction

After the 2006 period and the actual one, they're characterized for its consolidated VSE group with a great maturity on the software quality subject. These companies become the reference for the new companies that enter ParqueSoft. This group of companies has normalized the processes through ISO 9001 stardard. The challenge now is to maintain the management quality and achieve the improvement of software development processes supporting relying on new industrial referents.

ParqueSoft's experience on software integration projects, it addresses the interests toward a new market segment. Integration projects of contained multimedia and interactive for the development of the implementation of thematic parks. This is a new challenge for ParqueSoft's quality strategy. Now there is a new quality dimension that's taken interest: The use ability in contained multimedia.

The proposed pattern of quality iterative, that has been developed in ParqueSoft, now has a prevention focus more then a correction. It's the moment to work in tow of the fundamental causes by which nonconformities are identified on the test process. The definition, specification and software management requirements and the configuration control of the product sources.
The work on management requirements and the configuration control is done under two perspectives. The software engineering laboratory confirms pilot groups that are in charge of consolidating a good method in each area, define the working method and evaluate a support tool for the process. GreenSQA, a company that implements the quality strategy, defines the

method and instruments to do the software static tests. Exactly the activities of requirement revision, design revisions, code inspections and release revisions.

On this new step the model proposed by the quality strategy has evolved as follows: static tests on the beginning stages of software development, functional tests, performance tests, use ability tests, compatibility tests and security tests. Installation tests accompanied by an activity of release revision. In the process dimension, certified ISO9001 organizations, with a high maturity in the software development process through the implementation of some CMMI process areas: Requirement Management, Configuration Management, Planning, Monitoring, Control and Processes Measurement. Software Methodology tests, are now improved with software tools integration that automates the execution of tests. These tools are used for regression tests or yield tests, activities that require more efficiency.

From the first companies to the ones created in ParqueSoft, they understand the potential impact of the quality strategy they can achieve in the global industry. According to the type of project, maturity of the company software development and the current state of product development; the quality strategy is identified for the software product and the organization. It guarantees that quality activities executed add a value to the product quality and maturity of the organization.

On the third phase of the quality strategy implementation, training courses are formalized on different software quality topics. These courses are fundamental inputs for the program that are empowered by ParqueSoft's human talent strategy and for the formation of elective subjects for the systems engineering program of some universities of the region.

The same way an invigoration project of the software quality and development practice of Colombia ParqueSoft's' companies by the economical support of USAID[5], by means of the MIDAS program. Training activities were carried out on software quality that impacted 100 companies in different country regions. Additionally 150 static tests activities were committed, of which 30% of it has been accomplished.

The following table allows to evidence the quantitative results of the job done up to the moment by the quality strategy.

Average number of testers	15
Quantity of Not conformities	41.841
Efforts Inverted	224.536 HH
Impressed companies	128
Software Products Impressed	397
Software Products Certificate	145
Impressed Companies ISO9001	11
Certificate companies ISO9001	6
Traning	100 Empresas

[5] USAID, U.S. agency to extend assistance to countries recovering from disaster, trying to escape poverty, and engaging in democratic reforms.

Next Step: The Quality Strategy Future

Inside the growing projections of ParqueSoft's quality strategy, the accompaniment in the implementation of the CMMI model is found. Generating a bigger recognition and international projection of the current companies that have implemented the other quality practices defined by the strategy.

Another project that's planned is the definition of an industrial profile of software development under ParqueSoft context. Currently it has a great information repository of the software development process of about 300 companies. Therefore, the possibility of designing a fuzzy logic based system is evaluated with the objective of carrying out a preview to the software products evaluation a classification with relationship to the quantity of nonconformities that are supposed to be found during the evaluation process. The proposal incorporates the learning concepts of the neurons network to the diffuse inference systems to predict the ideal threshold of liberation of the product been evaluated.

The new companies, companies that currently joined ParqueSoft already know the complete path to implementation quality strategy; therefore, after a first diagnose of the maturity level, they are able to start implementing the best practices to reach an efficient capacity and an appropriate software development.