Chapter 3

Project Costs and Risks Estimation Regarding Quality Management System Implementation

Adela-Eliza Dumitrascu and Anisor Nedelcu

Additional information is available at the end of the chapter

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1. Introduction

Project management is the art — because it requires the skills, tact and finesse to manage people, and science because it demands an in-depth knowledge of an assortment of technical tools, of managing relatively short-term efforts, having finite beginning and ending points, usually with a specific budget, and it must meet or exceed customers' needs and expectations (Duicu et al., 2011). This involves balancing competing demands among:

- Scope, time, cost and quality;
- Stakeholders with different needs and expectations;
- Identified requirements and expectations.

All projects share the same characteristic - the design ideas and transform them into new activities and achievements. Elements of risk and uncertainty always present show that the activities and tasks necessary to implement the projects may never be planned with absolute accuracy when very complex projects, the very possibility of their successful completion can sometimes be called into question. Project management follows the processes and guidelines established by the PMI, (2004).

Project management uses a set of principles, rules, expertise, methods and tools for planning, necessary to start the deployment and successful completion of a project. In addition, project management is a system based on: financial resources, human and time.

Within each phases of project development, there are many processes, which must be completed before a project can move into the next phase. Project Management Institute suggests that the five process control groups should be used to define these processes within each phase of a project for a successful implementation. Based on the classification of each project, different combinations of processes should be used to successfully complete the project. Some factors included in this measurement of classification include complexity of scope, risk, size, period, institutional experience, and access to resources, maturity, and industry and application area. The figure 1 provides an overview of the process groups that will be implemented in any phase of a project (ASU, 2012).

One of the key elements of the competitiveness is quality. Quality management is an essential component of the project management along with other processes. Growth and continuous improvement of performance of a project depends heavily on how to ensure proper management of quality. Quality of project management not only refers to time and budget, but to specification and quality requirements.

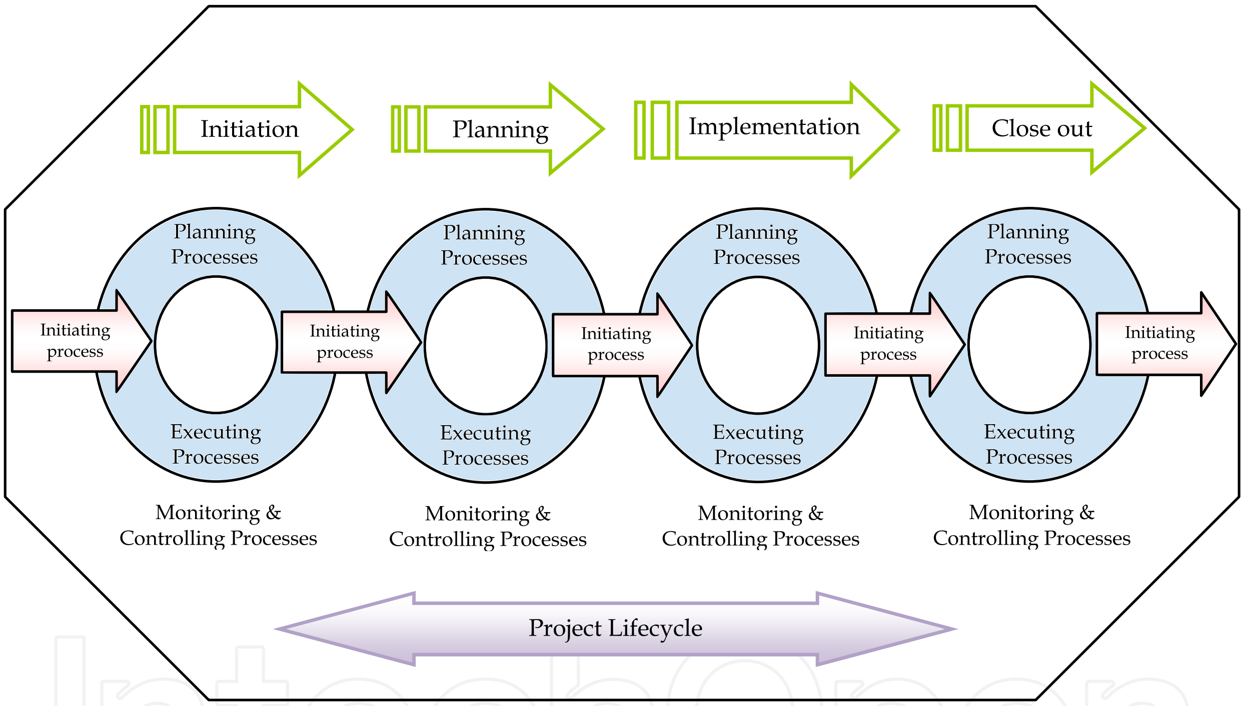

Figure 1. Project process groups

Project quality management consists of processes to ensure that the project will meet the requirements defined and planned, that quality planning processes, quality assurance and quality control (PMD, 2008).

Project quality management includes all management activities that will ensure the quality policy, objectives, and responsibilities and fulfill them through planning and improving quality through quality assurance and quality control. The project quality management processes are specified in figure 2.

Figure 2. Project quality management processes

Project quality management is the process required that ensures that the project meets requirements and expectations of the beneficiary involved in the project consists of: identification of relevant quality levels for the project and how to meet them, planned activities implemented quality system intended to ensure that the project will be within the parameters of quality planning, monitoring results of project activities and assessing their quality standards, ways to eliminate the causes which led to unsuccessful and continuous improvement (Nedelcu & Dumitrascu, 2010).

In figure 3 is illustrated an approach model of the quality management system in projects.

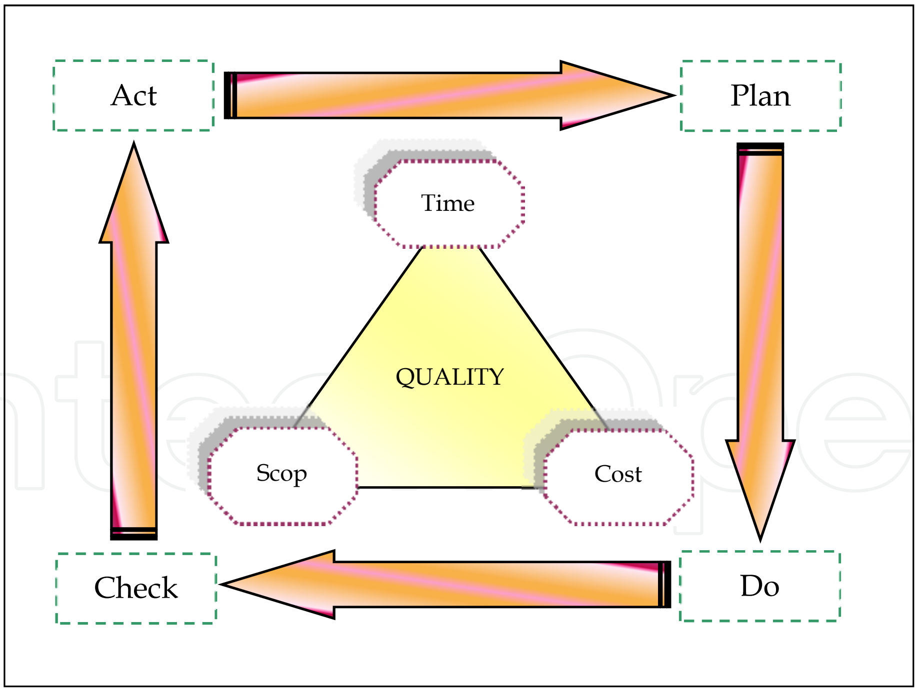

Figure 3. Project quality management

Quality management is a continuous process that starts and ends with the project. It is part of every project management processes from the moment the project initiates to the final steps in the project closure phase.

The purpose of quality management system is:

- To exclude possible errors in planning, coordination and all other phases;
- To ensure a controlled way that qualitative requirements on processes, approaches and products are respected at all stages;
- To find faults / errors as soon as possible, remove them and determine measures to avoid repeated mistakes;
- Check permanent measures to ensure quality and efficiency, the need to initiate corrective action;
- To determine and initiate corrective action / preventive measures.

2. Projects costs management

2.1. Theoretical aspects

Project cost management includes the processes involved in planning, estimating, budgeting, and controlling costs so that the project can be completed within the approved budget. The related knowledge area processes are (PMI, 2004):

- Cost estimating – developing an approximation of the costs of the resources needed to complete project activities;
- Cost budgeting – aggregating the estimated costs of individual activities or work packages to establish a cost baseline;
- Cost control – influencing the factors that create cost variances and controlling changes to the project budget.

According to the American Association of Cost Engineers, cost engineering is defined as that area of engineering practice where engineering judgment and experience are utilized in the application of scientific principles and techniques to the problem of cost estimation, cost control and profitability.

Project cost management is primarily concerned with the cost of the resources needed to complete schedule activities. Project cost management should also consider the effect of project decisions on the cost of using, maintaining, and supporting the product, service, or result of the project. Life-cycle costing, together with value engineering techniques, can improve decision-making and is used to reduce cost and execution time and to improve the quality and performance of the project deliverable. On some projects, especially ones of smaller scope, cost estimating and cost budgeting are so tightly linked that they are viewed as a single process that can be performed by a single person over a relatively short period of time. These processes are presented here as distinct processes because the tools and techniques for each are different. The ability to influence cost is greatest at the early stages of the project, and this is why early scope definition is critical (PMI, 2004).

The dependence between project cost management processes and project phases are detailed in table 1.

Process	Project phase	Key deliverables
Estimate costs	Planning	Activity cost estimates, Basis of estimates
Determine budget	Planning	Cost performance baseline
Control costs	Monitoring and controlling	Work performance measurements

Table 1. Processes and phases of project cost management

Project cost estimates are a key component of the planning process and provide a basis for key decisions. Cost estimate represents a prediction of quantities, cost, and/or price of resources required by the scope of an asset investment option, activity, or project. As a prediction, an estimate must address risks and uncertainties. Estimates are used primarily as inputs for budgeting, cost or value analysis, decision making in business, asset and project planning, or for project cost and schedule control processes. Cost estimates are determined using experience and calculating and forecasting the future cost of resources, methods, and management within a scheduled time frame (ISO, 2010).

An activity cost estimate is a quantitative assessment of the likely costs of the resources required to complete schedule activities. This type of estimate can be presented in summary form or in detail. Costs are estimated for all resources that are applied to the activity cost estimate. This includes, but is not limited to, labor, materials, equipment, services, facilities, information technology, and special categories such as an inflation allowance or cost contingency reserve.

The level of quality can be assessed with costs. It is normal for an organization to strive for the high quality products and services, but this procedure should not result in expenses that may cause, in turn, its bankruptcy. Thus, it is necessary to develop a budget for improving the quality and compared with expected profit. It is also necessary to establish special measures for sub-suppliers quality assurance, quality system continuously monitored, providing feedback information.

Data quality control is essential to ensure the integrity of results from quality improvements projects. Feasible methods are available and important to help to ensure that stakeholder's decisions are based on accurate data.

2.2. Costs estimation methods - modeling and simulation

Estimating the cost of project is one of the most crucial tasks for project managers. The main factors that are typically estimated at the beginning of a development project are: cost, size, schedule, quality, people resources, effort, resources, maintenance costs, and complexity. Cost estimation tools, or model-based estimation techniques use data collected from past projects combined with mathematical formulae to estimate project cost. They usually require factors such as the system size as inputs into the model.

The major software cost and schedule estimation techniques can be grouped and classified as regression-based models, learning-oriented models, expert based approaches and finally composite-Bayesian methods (Keaveney & Conboy, 2011). Therefore, there is a natural erroneous tendency associated with any form of estimation primarily because "an estimate is a probabilistic assessment of a future condition" and accuracy can therefore rarely be expected in the estimation process (Stamelos & Angelis, 2001). The causes of inaccurate estimates in development projects were grouped into four categories by Lederer & Prasad (1995), namely methodology, politics, user communication and management control.

A project simulation uses a model that translates the uncertainties specified at a detailed level of the project into their potential impact on project objectives. Simulations are typically performed using the Monte-Carlo technique.

In Monte-Carlo method calculations are repeated several times using the same, deterministic model of a physical phenomenon, but each time for different, randomly selected values of particular arguments, from among uncertainty range given a priori.

In a simulation, the project model is computed many times (iterated), with the input values randomized from a probability distribution function (e.g., cost of project elements or duration of schedule activities) chosen for each iteration from the probability distributions of each variable. A probability distribution (e.g., total cost or completion date) is calculated.

The Monte-Carlo technique is a device for modeling and simulating processes that involve chance variable. Monte-Carlo simulation requires hundreds or thousands of iterations. Each sample yields one possible outcome for the variable(s) of interest. By studying the distributions of results, we can see the range of possible outcomes and the most likely results. Using simulation, a deterministic value can become a stochastic variable. We can then study the impact of changes in the variable on the rest of the spreadsheet.

One of the most used distributions is the triangular because the input data can be obtained very easily and it does not require laborious investigations. Recent popularity of the triangular distribution can be attributed to its use in Monte Carlo simulation modeling and its use in standard uncertainty analysis software. The triangular distribution is also found in cases where two uniformly distributed errors with the same mean and bounding limits are combined linearly (Castrup, 2009).

Uncertainties may be modeled by the distribution where Johnson and Kotz (1999) discuss the asymmetric triangular distribution. Suppose that:

$$x_i = \begin{cases} a + \sqrt{z_i \cdot (b-a) \cdot (m-a)}, a < x_i \le m \\ b - \sqrt{(1-z_i) \cdot (b-a) \cdot (b-m)}, m < x_i \le b \end{cases}, \tag{1}$$

where $\hat{a}$ is lower estimate, $\hat{m}$ is most likely estimate value and $\hat{b}$ is maximum estimate value.

The mean and standard deviation are given by:

$$\mu = \frac{a+m+b}{3}, \tag{2}$$

$$\sigma = \sqrt{\frac{a^2 + m^2 + b^2 - am - ab - mb}{18}} . \quad (3)$$

The distribution emerges in numerous papers (Mohan et. al, 2007; Keefer & Verdini, 1993) and the probability density function for asymmetric three-parameter is given by:

$$f(x) = \begin{cases} \frac{2(x-a)}{(b-a)\cdot(m-a)}, a < x \le m \\ \frac{2(b-x)}{(b-a)\cdot(b-m)}, m < x < b \\ 0, elsewhere \end{cases} . \quad (4)$$

Cumulative distribution function is defined by:

$$F(x) = \begin{cases} 0, x \le a \\ \frac{(x-a)^2}{(b-a)\cdot(m-a)}, a < x \le m \\ 1 - \frac{(b-x)}{(b-a)\cdot(b-m)}, m < x < b \\ 1, x \ge b \end{cases} . \quad (5)$$

Cumulative distributions functions are usually presented graphically in the form of ogives, where we plot the cumulative frequencies at the class boundaries. The resulting points are connected by means of straight lines, as shown in chapter 2.3.

If the relative frequency is plotted on normal probability graph paper the ogive will be a straight line for a normally distributed random variable. The normal probability graph paper is a useful device for checking whether the observations come from a normally distributed population, but such a device is approximate. One usually rejects normality when remarkable departure from linearity is quite evident (Gibra, 1973).

2.3. Case study regarding project cost estimation of the quality management system implementation

Implementation of a quality management system (QMS) takes a lot of time and effort, whereas the top management wants benefits on a short period of time. The purpose of this case study is to provide the applicative aspects of project costs estimation of a QMS implementation.

The specific objectives achieved by this project are:

- Correct identification of processes within the organization;

- Development of specific documents of the QMS (quality manual, documented procedures of quality management system, specific documents);
- Implementation and certification of QMS according to ISO 9001:2008 accredited by a recognized certification organization in order to increase the performances of the own organization.

Quality management system implementation aims:

- Ongoing activities to meet customers' expectations;
- Products comply with applicable standards or specifications;
- Products offered at competitive prices;
- Products obtained in terms of profit.

The profit can be obtained by applying a rigorous prediction of specific costs. There plays a significant role the application of efficient and effective cost management. The project must be within allocated budget. Competitiveness of products and services is linked to quality. To achieve the objectives is not sufficient to implement the various techniques and methods, but quality must be acknowledged and implemented in all fields and at all levels. All these are possible only by introducing and supporting the documentation of quality management system.

Quality management system will assist by:

- Managing costs and risks;
- Increasing effectiveness and productivity;
- Identifying improvement opportunities;
- Increasing customer satisfaction.

A well-managed quality system will have an impact on:

- Customer loyalty and repeat business;
- Market share and industry reputation;
- Operational efficiencies;
- Flexibility and ability to respond to market opportunities;
- Effective and efficient use of resources;
- Cost reductions and competitive advantages;
- Participation and motivation of human resources;
- Control on all processes within organization.

Project quality evaluation represents an essential component of project success. The implementing process of a quality management system in an organization may be considered as a project. The general objective of this project is implementation, maintaining, certification and continuous improvement of the quality management system in organization in accordance with ISO 9001:2008. Therefore, in figure 4 are detailed the phases within a project's lifecycle and it will be considered complete and operational.

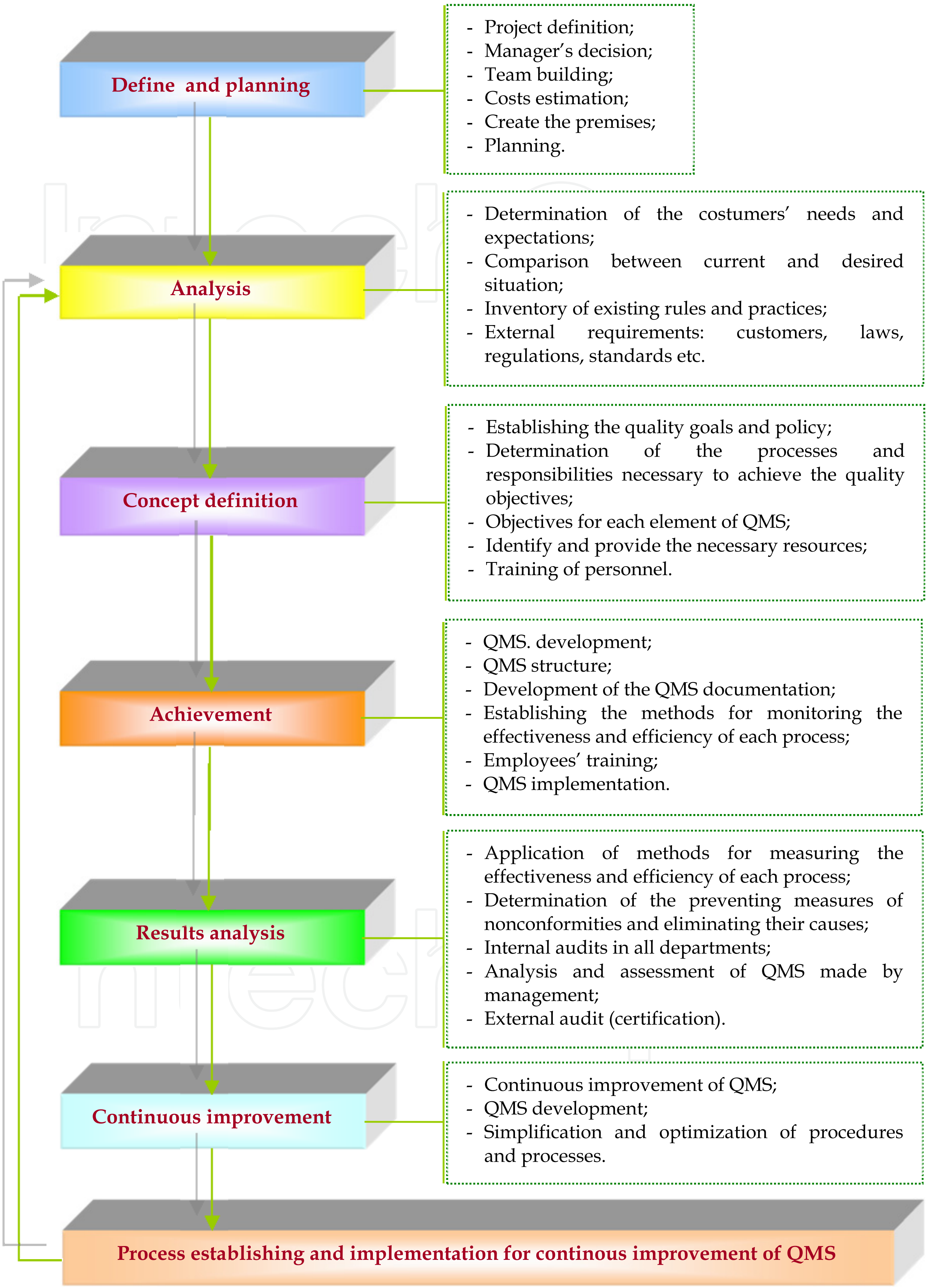

Figure 4. Project phases of a quality management system implementation

The applicative researches focuses on the relevant activities related to the QMS implementation and it covers the following stages:

- Diagnostic audit according to ISO 9001:2008 requirements;
- Establishing the quality policy and goals;
- Establishment of quality management program;
- Training of top management team;
- Initial evaluation, processes planning and identification relevant to quality system;
- Development of the quality management system documents;
- Approval, multiplication and dissemination of quality management system documents;
- Implementation of quality management system;
- Documentation for certification of quality management system;
- Preliminary discussion with selected accredited (optional);
- Internal quality audit;
- Transmission the documents of quality management system to certification organization (quality manual, procedures, work instructions);
- Reviewing the documentations by certification organization;
- Audit plan;
- Certification audit;
- Surveillance audit (annual);
- Recertification audit (three years).

For the most important tasks that imply substantial costs for QMS implementation process it was performed the simulated researches of the project activities costs using triangular distribution. The analyzed activities are presented in figure 5.

Figure 5. Main stages of quality management system implementation specific to costs simulation process

To estimate the cost of an activity we need to know how long it can run, that human or material resources will be involved, raw materials and materials used in the execution of activities. Consequently, the estimation process in a project must start from the estimation times. To do this, we can assess the effort required to execute each task.

Considering the steps of quality management system implementation described above, the Monte-Carlo simulation program is detailed in figure 6.

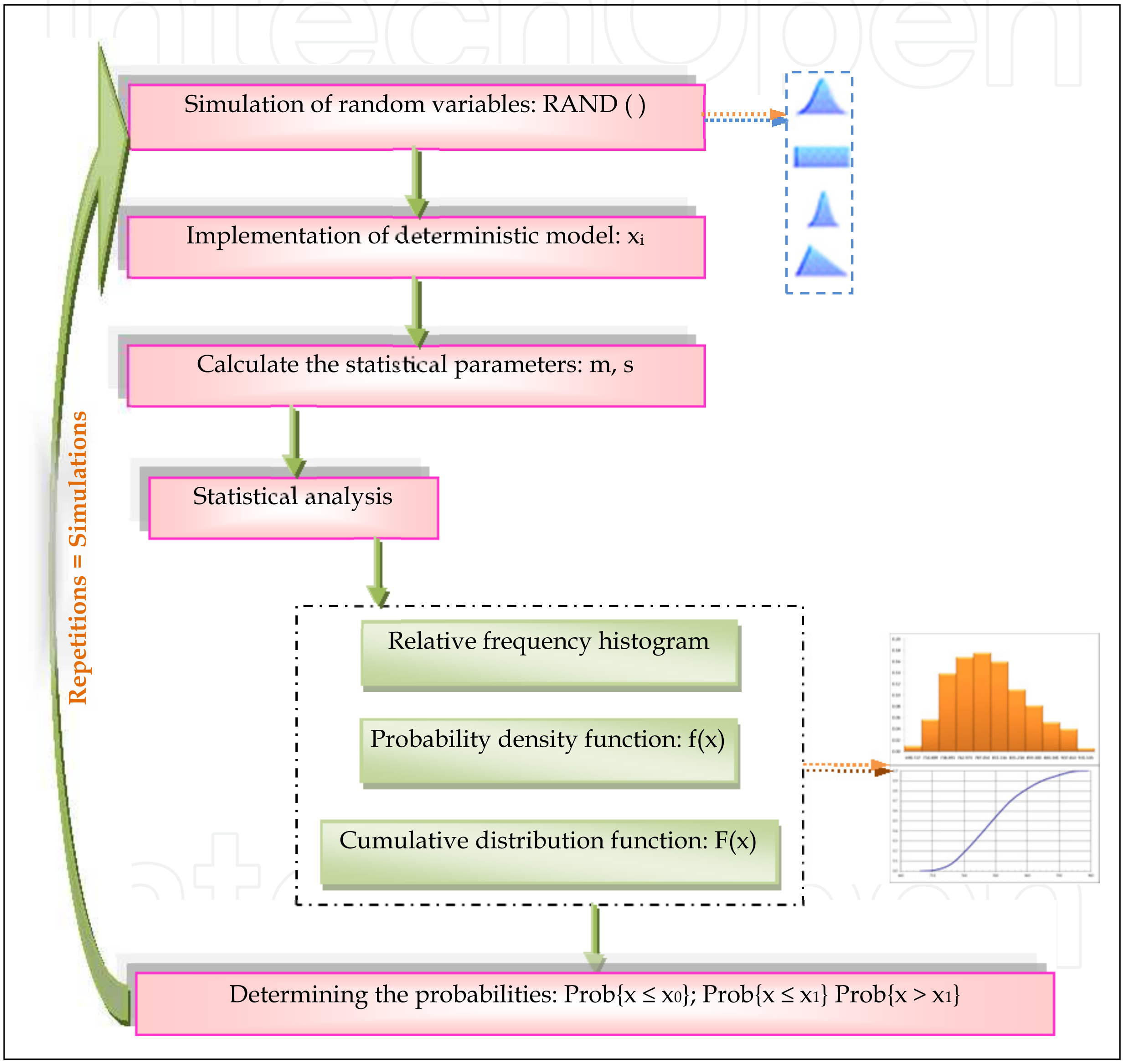

Figure 6. Monte-Carlo simulation program

Excel is not optimized for statistics, so other vendors have created add-ins offering more features. They not only calculate probabilities, but also permit Monte Carlo simulation to draw repeated samples from a distribution.

Consider an outcome, such as the task cost and we want to simulate what the actual costs might be if we know the lowest cost, the highest and the most likely. As a result, the simulation of specific costs for analyzed activities are represented by relative frequency histograms (see figure 7, figure 9, figure 11, figure 13, figure 15, figure 17, figure 19). If we run a stochastically simulation on these tasks costs, it can construct a relative cumulative frequency graph (ogive chart) for these data and looks like in figure 8, figure 10, figure 12, figure 14, figure 16, figure 18, figure 20). Cumulative distribution curve indicates the probability that we will complete this project tasks in less cost than the deterministically predicted. Each time the simulation is executed, the cell will be updated to show a random value drawn from the specified distribution.

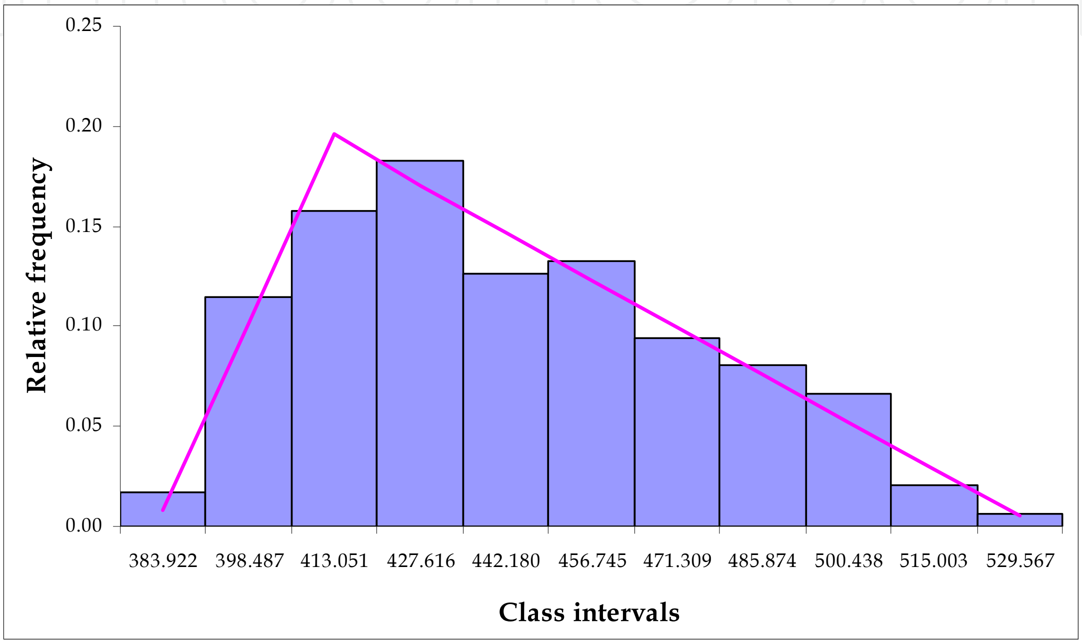

Figure 7. Relative frequency histogram for task 1

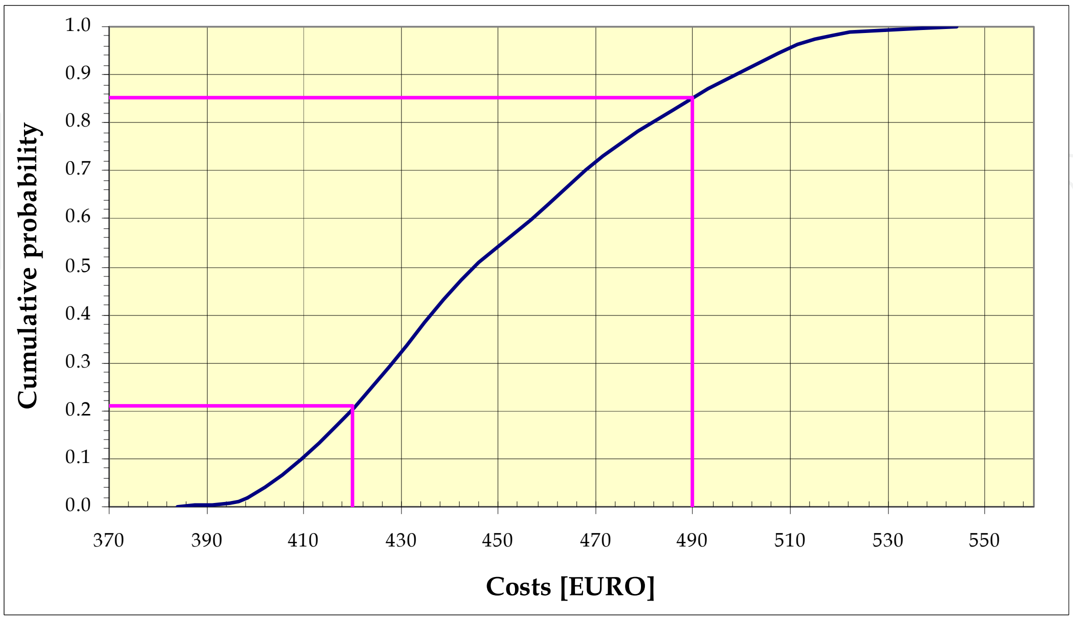

Figure 8. Cumulative frequency distribution for task 1

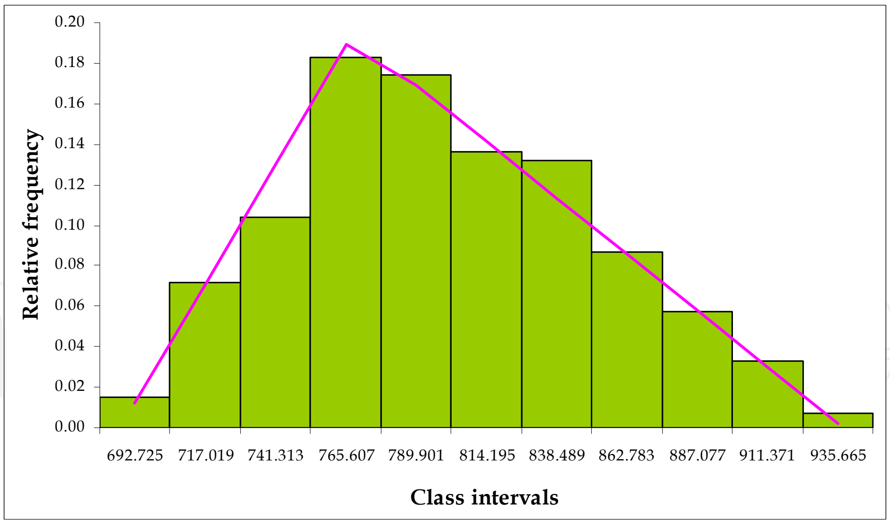

Figure 9. Relative frequency histogram for task 2

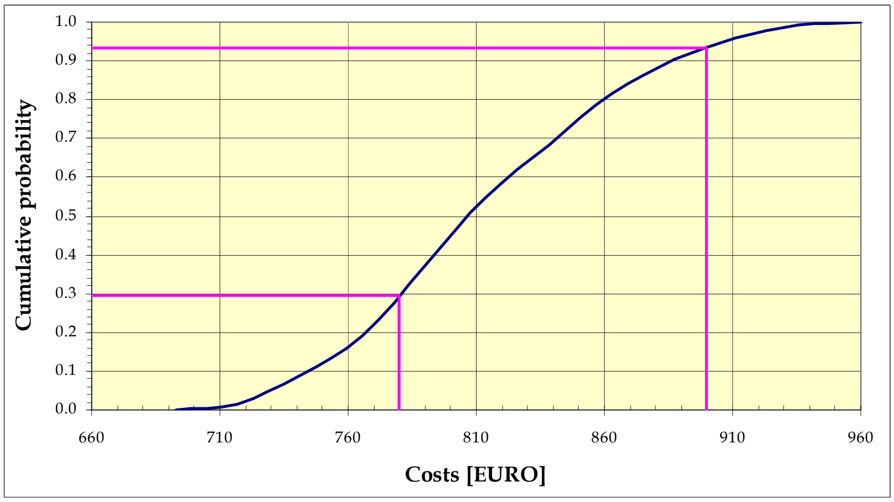

Figure 10. Cumulative frequency distribution for task 2

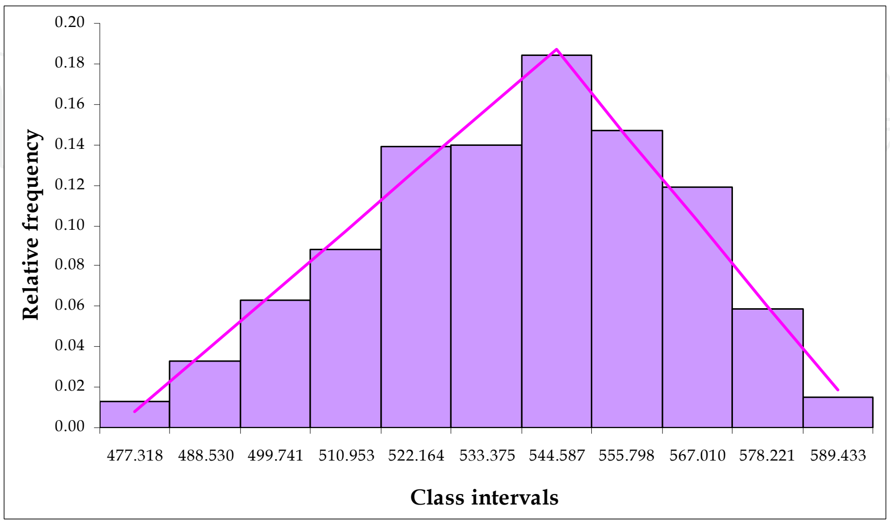

Figure 11. Relative frequency histogram for task 3

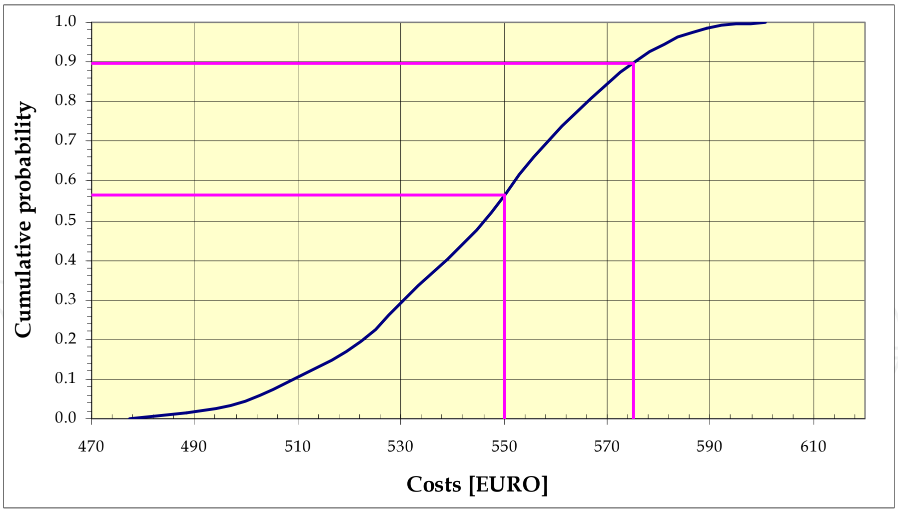

Figure 12. Cumulative frequency distribution for task 3

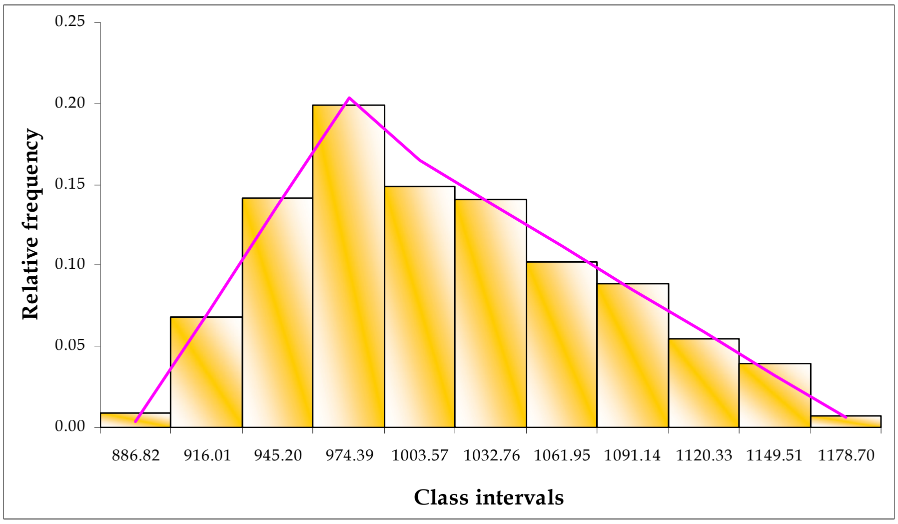

Figure 13. Relative frequency histogram for task 4

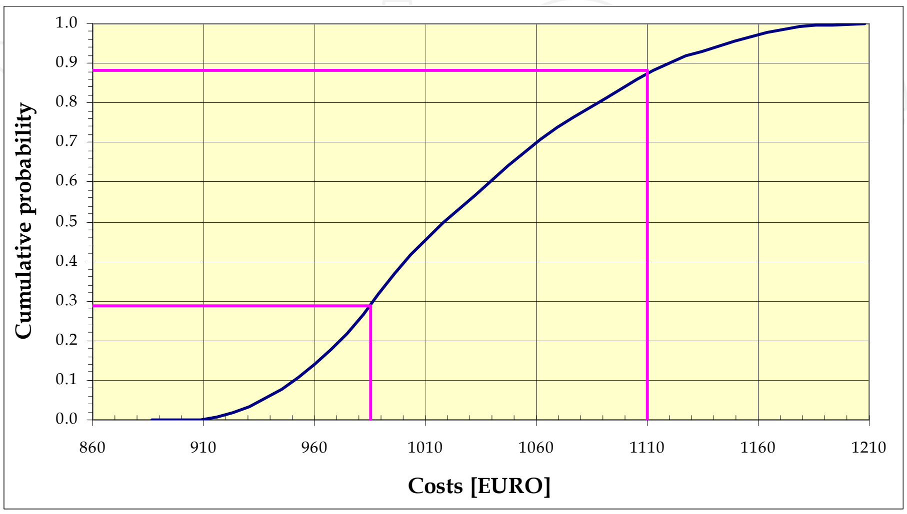

Figure 14. Cumulative frequency distribution for task 4

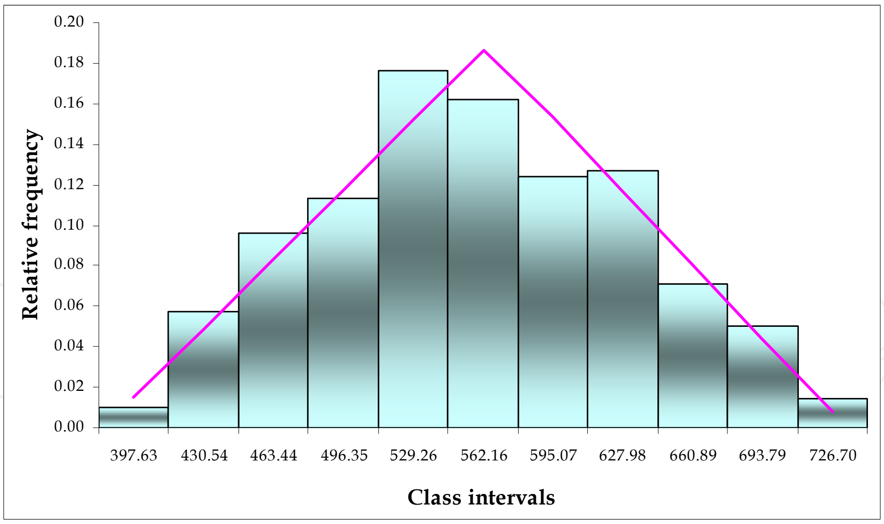

Figure 15. Relative frequency histogram for task 5

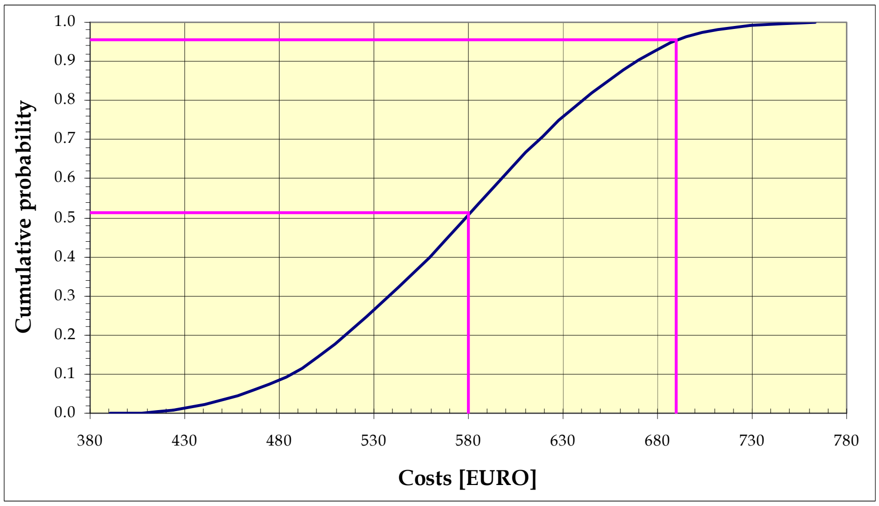

Figure 16. Cumulative frequency distribution for task 5

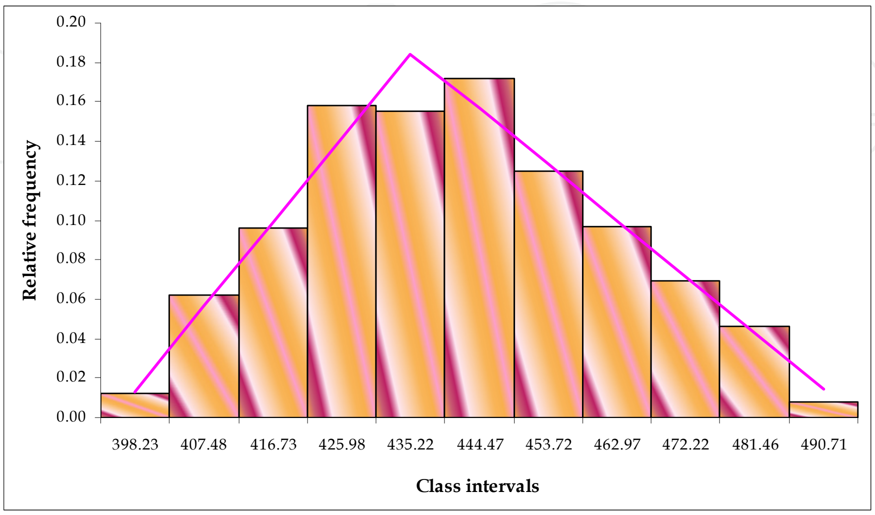

Figure 17. Relative frequency histogram for task 6

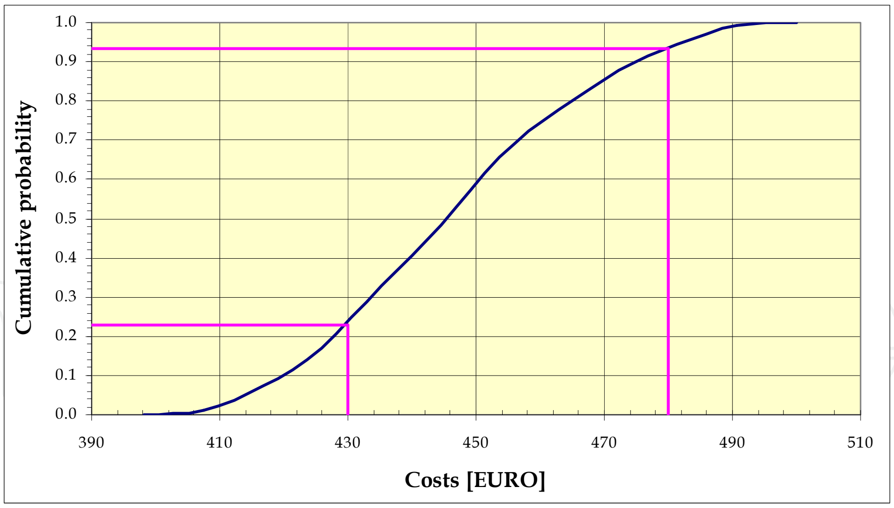

Figure 18. Cumulative frequency distribution for task 6

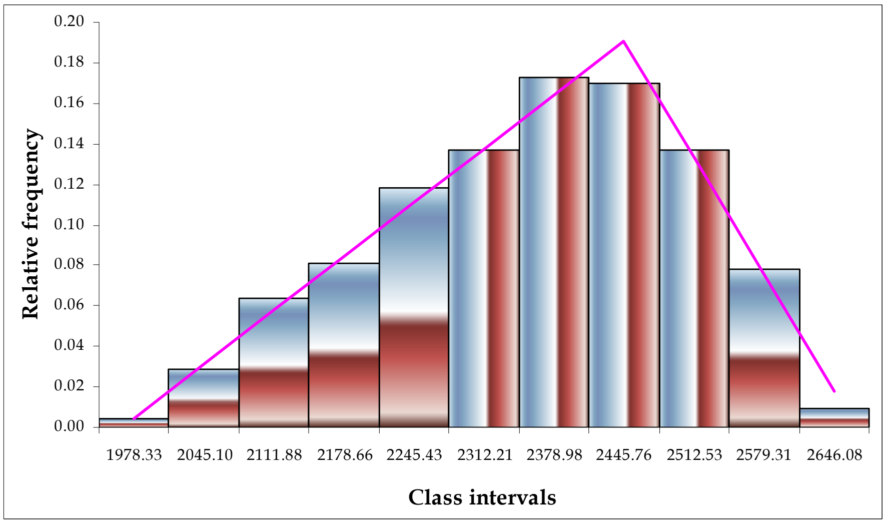

Figure 19. Relative frequency histogram for task 7

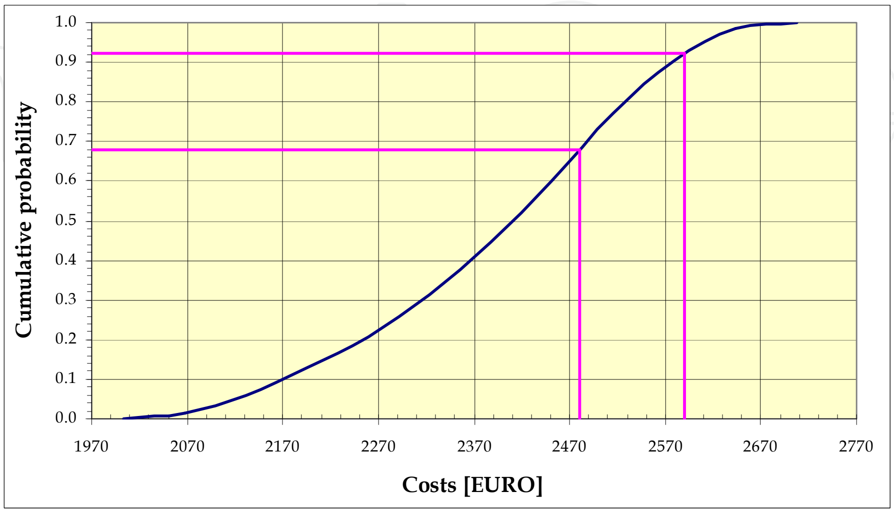

Figure 20. Cumulative frequency distribution for task 7

In table 2 are detailed the input data and the results of simulation process. It can be observed that the probability to exceed the maximum allocated costs of the tasks is smaller than 14%. Taking into account the contingency funds for the overall project tasks (approximately 10-20%), we will be able to accomplish the project activities with the planned costs and time.

Tasks	Minimum	Likely	Maximum	Prob{$x \le x_0$}	Prob{$x \le x_1$}	Prob{$x > x_1$}
Activity 1	390	420	550	0.212	0.863	0.137
Activity 2	700	780	950	0.292	0.937	0.063
Activity 3	400	550	600	0.561	0.891	0.109
Activity 4	900	985	1200	0.283	0.864	0.136
Activity 5	400	580	750	0.514	0.956	0.044
Activity 6	400	440	500	0.226	0.926	0.074
Activity 7	2000	2480	2700	0.679	0.923	0.077

Table 2. Simulation process results

Analyzing the relative frequency histograms, it can be seen the standard asymmetric triangular distribution. For activities where the distribution is skewed to the left, we might finish the tasks ahead of schedule and for the distribution is skewed to the right, the project implies supplementary costs.

3. Projects quality improvement through risks management process

Management of risk is an integral part of good business practice and quality management. Learning how to manage risk effectively enables managers to improve outcomes by identifying and analyzing the wider range of issues and providing a systematic way to make informed decisions. A structured risk management approach also enhances and encourages the identification of greater opportunities for continuous improvement through innovation (AUSAID, 2006).

Project risk management offers a great opportunity to improve project performance dramatically. The amount of work needed to implement the project risk management process is considerably less than that devoted to other project variables such as cost, schedule, or quality, yet the benefits are equally great. The greatest challenge to implementing a project risk management lies in changing corporate culture. However, once this is done, and risk management becomes routine, it will add greatly to the probability of project success (Naughton, 2012).

To be competitive, an organization must be proactive in managing the risks to successful achievement of the cost and schedule objectives for its projects. The risks management implementation can improve the quality of supplied products and processes through the identification, monitoring and control of risks.

3.1. Concepts, principles and components of risks management

Project risk represents uncertain events or situations that potentially can adversely affect a project as planned, usually in terms of cost, schedule, and/or product quality.

Project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project; most of these processes are updated throughout the project (PMI, 2004). It involves processes, tools, and techniques that will help the project manager to maximize the likelihood and consequences of positive events and minimize the probability and consequences of adverse events. In figure 21 it is shown the processes of project risk management.

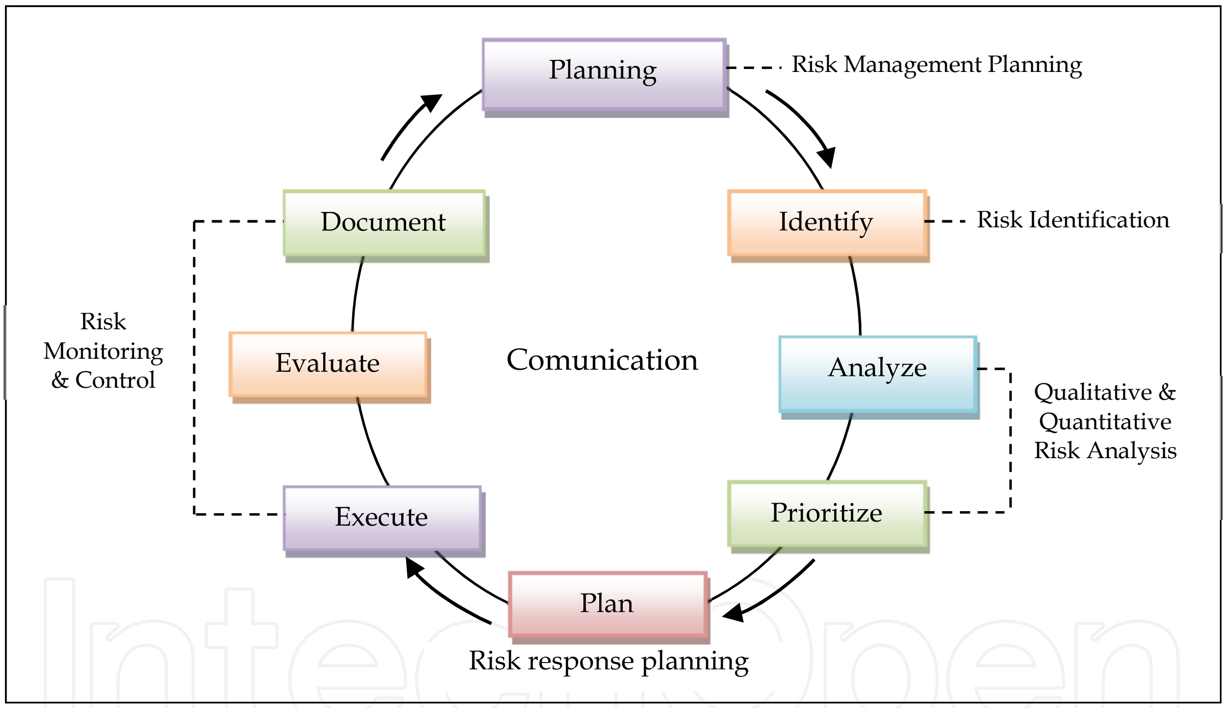

Figure 21. Project risk management process

Risks are prioritized according to their potential implications for meeting the project's objectives. A risk matrix is used to combine likelihood and impact ratings values to obtain a risk score. The risk score may be used to aid decision making and help in deciding what action to take in view of the overall risk. How the risk score is derived can be seen from the sample risk matrix shown in table 3. The organization can define as many risk levels as it believe are necessary. In our case the matrix presents tree domains: high, moderate and low risks.

Probability					
0.90	0.05	0.09	0.18	0.36	0.72
0.70	0.04	0.07	0.14	0.28	0.56
0.50	0.03	0.05	0.10	0.20	0.40
0.30	0.02	0.03	0.06	0.12	0.24
0.10	0.01	0.01	0.02	0.04	0.08
	0.05	0.10	0.20	0.40	0.80
Impact					

Table 3. Risk assessment with risk matrix

3.2. Risks estimation of quality management system implementation

Risk management for implementing a QMS consists of dealing with big and small objections, coming from people all over the organization, and can, in general, not be quantified in the same way as the risks in a production process (CERCO, 2000).

Risk management is a facet of quality, using basic techniques of analysis and measurement to ensure that risks are properly identified, classified, and managed.

The main objectives of this case study are:

- Identification and definition of risks categories;
- Establishing the criteria (factors) of risks analysis and their levels of assessment;
- Determining the risk score;
- Risk ranking in three categories: high, medium or small level;
- Risks prioritization and implement the corrective or preventive actions.

3.2.1. Risks Identification

It is evaluate the potential risks to the opportunity, to be able to build a project plan that maximizes the probability of project success. Risk identification is generally done as part of a feasibility study, at the beginning of the active project work, and at each new phase of a large project.

The project team considers:

- Risks: what might go wrong;
- Opportunities: better methods of achieving the project's purpose and need;
- Triggers: symptoms and warning signs that indicate whether each risk is likely to occur.

After the assessment, risk categories that influence the project development of the quality management system implementation are detailed in table 4.

Risks categories	Risk description
Quality risk	Risk that influence product quality or service supplied
Project management risk	Risk which influence development of the project due to the planning process.
Internal risk	Risk influencing the project development caused internal factors of the organization
External risk	Risk affecting the whole system caused by the changes of external entities (importers, laws, authorizations, etc.)
Financial risk	Risk that affects the allocated budget

Table 4. Identified risks categories

3.2.2. Qualitative analysis

In this step are assessed the impacts of identified risks (table 5).

No.	Risks categories	Risk impact (I)	Risk impact evaluation
R1	Choosing a consulting organization that does not know / not to meet the requirements of field / organization	0.8	Major impact (catastrophic) on the project, such as deviations more than 25% from the project scope, schedule or budget
R2	Exceeding the budget	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R3	Exceeding allotted	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R4	Wrong identification of processes	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R5	Omission of the stages in the description of processes	0.2	Measurable impact on the project, such as deviations of 5-10% from the project scope, schedule or budget
R6	There are not evaluated all departments	0.2	Measurable impact on the project, such as deviations of 5-10% from the project scope, schedule or budget
R7	Incomplete planning of processes / products	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R8	Documentation is incomplete	0.1	Minor impact on the project, such as deviations less than 5% from the project scope, schedule or budget
R9	Evaluation is not real	0.1	Minor impact on the project, such as deviations less than 5% from the project scope, schedule or budget

R10	Documentation is imposed without discussed	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R11	Do not have "client" in center of processes	0.2	Measurable impact on the project, such as deviations of 5-10% from the project scope, schedule or budget
R12	Do not reflect the commitment for customer satisfaction	0.2	Measurable impact on the project, such as deviations of 5- 0% from the project scope, schedule or budget
R13	Establishment of unrealistic targets	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R14	It does not comply with annual audit plan	0.1	Minor impact on the project, such as deviations less than 5% from the project scope, schedule or budget
R15	Audits weren't done	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R16	Audits only formally	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R17	Unsolved of the prepared nonconformities report	0.05	Insignificant impact on the project. It is not possible to quantify the impact, which is extremely low.
R18	Decisions weren't fulfilled	0.1	Minor impact on the project, such as deviations less than 5% from the project scope, schedule or budget
R19	Resumption of process if it is found that implementation was not effective	0.8	Major impact (catastrophic) on the project, such as deviations more than 25% from the project scope, schedule or budget
R20	Audit report to be prepared superficially	0.1	Minor impact on the project, such as deviations less than 5% from the project scope, schedule or budget
R21	Incomplete documentation and the certification process extension	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R22	Delay to transmission of the audit plan	0.1	Minor impact on the project, such as deviations less than 5% from the project scope, schedule or budget
R23	Identification of major nonconformities	0.4	Significant impact on the project, such as deviations of 10-25% from the project scope, schedule or budget
R24	Isn't taken certification after audit	0.8	Major impact (catastrophic) on the project, such as deviations more than 25% from the project scope, schedule or budget

Table 5. Qualitative analysis of risks

3.2.3. Quantitative analysis

This process aims to analyze numerically the probability of each risk and consequences on project objectives (table 6).

No.	Risks categories	Likelihood (P)	Impact consequences
R1	Choosing a consulting organization that does not know / not to meet the requirements of field / organization	0.1	Certification is not obtained
R2	Exceeding the budget	0.9	More expenses than was anticipated
R3	Exceeding allotted	0.5	Financial losses and low productivity
R4	Wrong identification of processes	0.3	Delay to finish the project
R5	Omission of the stages in the description of processes	0.5	Delay to finish the project
R6	There are not evaluated all departments	0.5	There are not included all aspects
R7	Incomplete planning of processes / products	0.9	Delay to finish the project
R8	Documentation is incomplete	0.9	Delay to finish the project
R9	Evaluation is not real	0.7	Measures plans are not effective
R10	Documentation is imposed without discussed	0.7	Delay to finish the project
R11	Do not have "client" in center of processes	0.3	Delay to finish the project
R12	Do not reflect the commitment for customer satisfaction	0.3	Delay to finish the project
R13	Establishment of unrealistic targets	0.3	Delay to finish the project
R14	It does not comply with annual audit plan	0.7	Delay to finish the project
R15	Audits weren't done	0.1	Delay to finish the project / Certification is not obtained
R16	Audits only formally	0.1	Delay to finish the project / Certification is not obtained
R17	Unsolved of the prepared nonconformities report	0.3	Resumption of internal audits
R18	Decisions weren't fulfilled	0.3	Delay to finish the project
R19	Resumption of process if it is found that implementation was not effective	0.1	Delay to finish the project / Certificate wasn't taken at scheduled time
R20	Audit report to be prepared superficially	0.7	Certification is not obtained
R21	Incomplete documentation and the certification process extension	0.5	Delay to finish the project
R22	Delay to transmission of the audit plan	0.3	Delay to finish the project
R23	Identification of major nonconformities	0.5	Delay to finish the project
R24	Isn't taken certification after audit	0.3	Delay to finish the project

Table 6. Quantitative analysis of risks

3.2.4. Monitoring and control of risks

This stage supposes keeping track of identified risks, monitoring residual risks, and identifying new risks.

In table 7 are quantify the identified risks based on the risk matrix specified in table 3.

No.	Risks categories	Risk score (I x P)
R1	Choosing a consulting organization that does not know / not to meet the requirements of field / organization	0.08
R2	Exceeding the budget	0.36
R3	Exceeding allotted	0.20
R4	Wrong identification of processes	0.12
R5	Omission of the stages in the description of processes	0.10
R6	There are not evaluated all departments	0.10
R7	Incomplete planning of processes / products	0.36
R8	Documentation is incomplete	0.09
R9	Evaluation is not real	0.07
R10	Documentation is imposed without discussed	0.28
R11	Do not have "client" in center of processes	0.06
R12	Do not reflect the commitment for customer satisfaction	0.06
R13	Establishment of unrealistic targets	0.12
R14	It does not comply with annual audit plan	0.07
R15	Audits weren't done	0.04
R16	Audits only formally	0.04
R17	Unsolved of the prepared nonconformities report	0.015
R18	Decisions weren't fulfilled	0.03
R19	Resumption of process if it is found that implementation was not effective	0.08
R20	Audit report to be prepared superficially	0.07
R21	Incomplete documentation and the certification process extension	0.20
R22	Delay to transmission of the audit plan	0.03
R23	Identification of major nonconformities	0.20
R24	Isn't taken certification after audit	0.24

Table 7. Risks score

The identified risks are categorized by degrees of probability and impact, and they are distributed into high, moderate, and low risk categories.

After making analysis were results twenty-four risks for all stages of project development of a quality management system implementation. The most important risks that must be treated it can be seen in figure 22.

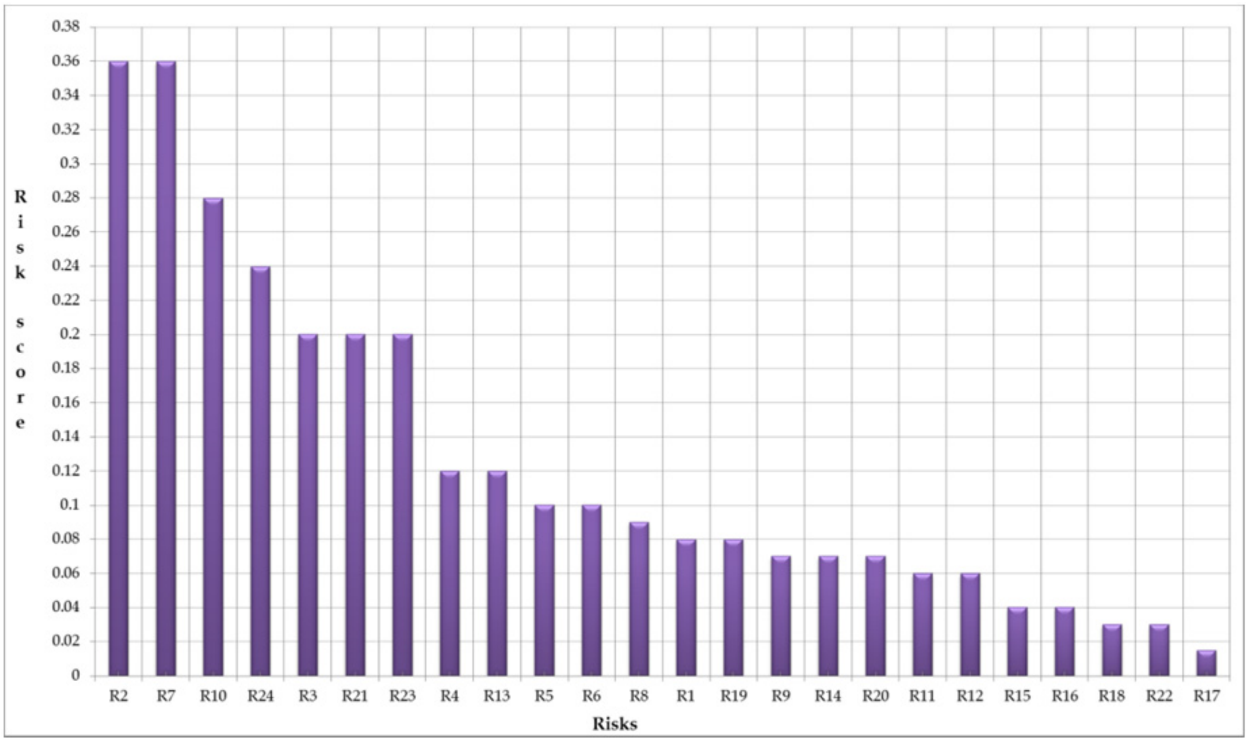

Figure 22. Risks prioritization

Also, implementing the monitoring and control plans, the risks situated in the high domain can be eliminated or minimized to a medium or low level.

Nothing can be controlled which cannot be measured. In a project there are three things which can always be measured - the schedule, the cost, and the users' satisfaction. If the project meets all these three criteria, it is right to consider it a successful project. If it meets two of them and comes close to the third it is probably successful. Few projects which are very late and very much over budget are considered to be successful and they meet the users' requirements. Therefore, the essence of risk management is the avoidance of anything which extends the schedule, increases the costs, or impairs the users' satisfaction with the product of the project.

4. Conclusions

Customer satisfaction provides valuable information for saving resources by tuning those processes and its quality aspects. Therefore the measurement of customer's satisfaction should be seen as an essential part of business management and should be carefully designed as one of the key measures of the success of an organization.

Monitoring quality costs is essential when implementing a quality management system as this gives relevant information about the balance between efforts and investments in quality to reduce non quality and what remaining non quality still costs. However it is difficult to identify all the relevant elements and the quality indicators are necessary because they provide a concrete tool to measure how the QMS is improving the organization's efficiency and effectiveness (CERCO, 2000).

The case study regarding costs estimation can be extending to the stochastically modeling of the total project schedules. There is uncertainty surrounding any estimate of how long a task will take. If it is a short, simple task we have done before, the uncertainty range may be so small that it can safely be ignored. With large, complex tasks, the uncertainty becomes very significant, especially if we're depending on factors beyond our control.

Anyone who is serious about realistically forecasting project schedules, anticipating potential trouble spots, and taking action to mitigate against likely problems – in other words, truly managing major projects, rather than just monitoring them – should be using Monte-Carlo simulation software to plan and analyze projects stochastically. It is the best way to avoid late and over budget problems. Simulation has many advantages for risk assessment. Among them are:

- Simulation forces us to state our assumptions clearly;
- Simulation helps us visualize the implications of our assumptions;
- Simulation reveals the potential variation in the variables;
- Simulation quantifies risk (the probability of a given event).

One of the key measures of the resilience of any project is its ability to reach completion on time and on budget, regardless of the turbulent and uncertain environment it may operate within. Cost estimation and tracking are therefore paramount when developing a system.

The magnitude of each costs components depends on the size of the organization, the nature of the project as well as the organization management, among many considerations, and the owner is interested in achieving the lowest possible overall project cost.

Budget estimate must be adopted early enough for planning long term financing of the facility. Consequently, the detailed estimate is often used as the budget estimate since it is sufficient definitive to reflect the project scope and is available long before the engineer's estimate. As the work progresses, the budgeted cost must be revised periodically to reflect the estimated cost to completion. A revised estimated cost is necessary either because of change orders initiated by the owner or due to unexpected cost overruns or savings (Dumitrascu et al., 2010).

When we plan a project, we are attempting to predict what will happen in the future what we will produce, by when, for how much money. Prediction is always fraught with uncertainty. Our estimates are usually wrong because we cannot accurately predict the future. This is why we need risk assessment - it helps us to manage the uncertainty of the future (Naughton, 2012).

The risks of implementing and maintaining a QMS are well known. Although they cannot necessarily be eliminated they can be managed, and their impact reduced.

Based on information, obtained risks score and analyzed the case study regarding the risk management applied to a quality management system implementation, we can draw the following conclusions:

- Identified risks have a significant level of appearance and a relatively small impact;
- It has been identified risks, and the appearance causes on which will be applied corrective or contingent actions;
- Risk management plan ensure the prevention and treatment of risks arising for each stage of implementation;
- Risk management plan can be rebuilt according to other risks identified in the project.

Also, the case studies can be extended to costs assessment of project risks.

It is important to determine quantitatively the impact of event risk and determine the risks that cause harm (or benefit) for the project. So, it can build the sensitivity. They are used to visualize possible effects on the project (the best results and lower) the different unknown variables than their initial values. Variable sensitivity is modeled as uncertain value, while all other variables are held at baseline (stable). Tornado diagram is a variation of sensitivity analysis where the variable with the greatest impact is positioned on top of the chart, followed by other variables, in descending order of impact. It can be used for sensitivity analysis of project objectives (cost, time, quality and risk) (Barsan-Pipu, 2003).

Author details

Adela-Eliza Dumitrascu and Anisor Nedelcu
"Transilvania" University of Brasov, Romania

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