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Considerations on Projects Quality

Wagner Costa Botelho*, Pedro Luiz de Oliveira Costa Neto*, Oduvaldo Vendrametto*

* Paulista University-UNIP, Graduate Program in Production Engineering, Dr. Bacelar St. 1212, Sao Paulo, Brazil

Email: wagner.costa.botelho@gmail.com, politeleia@uol.com.br, oduvaldov@uol.com.br

Abstract

The article discusses the projects regarding typification and quality. In this context, the following questions are appropriate: in which category does Project Engineering fit into? Does the development of projects represent the generation of a product or is it typically a service? In defence of the first possibility, it can be argued that the development of a project leads to a tangible result comprising of documents, drawings and specifications which then will allow, through their implementation, the realization of the purpose of the project. In defence of the second, one can say that these documents, drawings and specifications are actually intangible from the point of view of the real purpose of the project, which will only be achieved after its physical completion. In this article is discussed the characterization of Project Engineering such as generator of products and/or services, seeking to answer the above questions, as well as it is made an analysis of this important set of activities through the concepts and dimensions of quality embodied by literature.

Keywords: Approaches and dimensions of quality; projects typology; project clients and consumers; project quality management.

1 Introduction

In the development of the studies and research in order to understand and contribute to the continuous improvement of quality, a dichotomy emerged due to the differences of the efforts to be considered in each case: between generating tangible products, which have physical properties, and the offering of services, by their very nature intangible, to meet the specific consumers' needs.

Although the concept of quality, characterized by its five main approaches, as synthesized by Garvin (2002) - see Table 2 - is applicable to these two categories of items offered to the consumer, there are certainly important differences to be considered, as regards to production characteristics, the dimensions of quality and several other aspects.

In this context, one purpose of this article with a literature review to identify the suitability of the following questions: Which of these categories does Project Engineering fit into? Does the development of projects represent the generation of a product or is it typically a service? In defence of the first possibility, it can be argued that the development of a project leads to a tangible result comprising of documents, drawings and specifications that then will allow, through their implementation, the achievement of the purpose of the project.

In defence of the second one, it can be said that these documents, drawings and specifications are actually intangible from the point of view of the real purpose of the project, which will only be checked after its physical completion. In favour of this position, the example of medical care can be considered as an analogy, in which the customer, after a consultation, leaves the office with a prescription in hand which does not represent, in fact, a product in terms of actual use.

In this article is of fundamental importance we discuss the characterization of Project Engineering such as generator of products and/or services, seeking to answer the questions above, as well as an analysis of this important set of activities in the light of the concepts and dimensions of quality embodied by the literature. It is expected that this sheds light on this issue and gives rise to other possible discussions that should be considered in this respect.

The motivation for this study came with the perception that softwares are a kind of project and so the classification by Juran (2002), presented in 2.1., should also apply to them. To show this became the main objective to be studied.

To achieve this, it was used a set of references considered enough for the purposed in mind. It made possible to develop a rational analysis as show in the text.

2 Concepts linked to quality

In this item definitions, dimensions and other issues of interest to the study of quality are given, establishing a separation between the visions of quality experts in general and those of specialists more involved with Project Engineering.

2.1 Types of Production

The literature on quality has reflected a dichotomy between the production of tangible goods, by means of manufacturing activities and its congeners, whose results are generically referred to as "products", and the generation of intangible activities generally individualized, whose results are referred to as "services".

For reasons relating to the growing importance of manufacturing operations in the many factories that emerged after the advent of the Industrial Revolution, in particular during the course of the 20th Century, the concepts about quality were first developed connected to the industrial production of tangible goods, being subsequently adapted for the implementation of the services. These involve the additional difficulty of being heterogeneous, intangible, perishable and inseparable from the presence of the customer at the time of their completion, as well pointed out by Parasuraman (1985).

The differentiation between aspects of quality on these two characteristics is shown in 2.2. The different characteristic aspects of these two modes are presented in Table 1.

Table 1 – Comparison between products and services

Products	Services
Tangible, having physical properties	Intangible, incorporeal, do not have physical properties.
Performed along a production process	Performed instantly or in a short space of time.
They can be stocked and transported	They cannot be stocked nor transported.
Production occurs before consumption	Simultaneous production with consumption.
Production outside the scope of the customer	Production featuring the physical or virtual participation of the customer.
Generally homogenous forms of production	Heterogeneity in production, many ways for effective provision.
Easy to assess the quality	Difficult to assess the quality.

Source: Costa Neto and Canuto (2010)

To this subdivision, however, must be added the classification proposed by Juran (2002). This eminent quality guru, who used the term "product" without distinction to tangible goods or intangible services, proposed consideration of a third category, falling into neither of the two previous traditional categories, for software products like ERP systems, portals on the internet, operating systems, specific made-to-order programmes, etc.

Juran's proposition is perfectly justifiable, because, in fact, software has characteristics that prevent it from being comfortably classifiable in two traditional categories. In fact, observing the columns in Table 1, one may consider, upon initial analysis, that software is, in principle, performed over a production process, can be stocked and transported, production occurs before consumption, production has physical or virtual participation of the customer, it exhibits heterogeneity in production and it is difficult to assess the quality.

Regarding the first row of Table 1, one may consider, on the one hand, that software is tangible, has physical properties, if observed from the viewpoint of the hardware that houses it (CD, memory stick,

memory support), and, on the other hand, it is intangible, incorporeal, because we cannot touch it, having no physical properties.

Note also that the development of software, in itself, does not make sense unless we also consider its further use, i.e. the software exists as the product of a production process, it is identifiable, it has identifiable design features, but its actual use occurs with the use, and the result of such use has features that are more consistent with the provision of a service.

2.2 Visions of quality experts in general

The very concept of quality has been the subject of lengthy discussions between industry experts, leading to the consideration of views which, if they were not at all antagonistic, placed great emphasis on aspects of problems linked to the pursuit of quality of products and services.

It fell to Garvin (2002) make a summary of these ideas, featuring the five main approaches of quality presented in Table 2. This fortunate collocation of this prestigious author is quite useful for the purpose of analysis, although it should not, in our view, be considered to be formed by mutually exclusive nor exhaustive approaches.

Table 2 – Approaches to quality

Transcendental	Quality is synonymous with generally recognized excellence, based on high-level standards and marks.
Based on the product	Quality can be seen precisely and measurably, reflecting well determined characteristics that the product has, such as life cycle, accessories, roles that it performs, etc.
Based on the user	Quality is determined by meeting the needs of the user. It is therefore an approach of high subjectivity. It may be related to the marketing of the product or service.
Based on the process (or on production)	Quality is the correct service for product or service specifications. It relates to the engineering processes. It is an internal approach for the company and, in some ways, in the assumption that the design of the product or service meets the needs of the market.
Based on the value	Links the potential of the product or service with its price, which should be acceptable to the user.

Source: Adapted from Garvin (2002)

Analysing these approaches, Costa Neto and Rospi (2007) related to the customers' profile that prioritizes, which aspects should be prioritized by those responsible for quality and which aspects are not important, as shown in Table 3.

Table 3 – Priorities associated with approaches to quality

Approach	Who prioritizes	What is prioritized	What is not prioritized
Transcendental	Affluent Public Status	Excellence Producer	Cost
Product	Technically aware public	Usefulness of the product Meet needs	Superfluous
User	Majority public	Product appeal Market knowledge Cost	What escapes the majority view
Production	Market in general	Process Engineering Conformity	Market knowledge
Value	Economically aware public	Items that value without burdening	Superfluous

Source: Costa Neto and Rospi (2007)

Maximiniano (2010) includes some of the approaches to quality when he says that managing product quality begins by defining the specifications regarding its performance expected by customers, but extends the issue of quality also to the interests of stakeholders throughout the production process, both inside and outside the company.

In this line, and intrinsically concerned with ethical aspects, Cerquinho (1994) was daring by giving the following definition for the quality:

"Quality is the sum of all the characteristics and properties of goods and services that meet the reasonable needs of customers, along with the set of situations involved in obtaining and use of these products that promote a healthy and authentically human existence to all who are affected".

Reasoning about the quality of tangible products, Garvin (1984) suggested the existence of eight quality dimensions, presented in Table 4.

These dimensions, according to the words of Whithers and Ebrachimpour (2000), became a widely accepted taxonomy for discussions about quality products, sometimes also being used in the case of services.

Table 4 – Dimensions of quality for products

Dimensions	Concept
Performance	For the correct implementation of major activities for which the product was designed.
Complements	For items that add to the achievement of the main roles, helping to improve performance.
Reliability	Concerning safety in use, absence of risk and no occurrences of failures.
Conformity	Regarding compliance with project specifications.
Durability	Related to the product useful life.
Technical assistance	Relating to after-sales support and facilities for maintenance in the event of a failure.
Aesthetics	Referring to good look, good taste and pleasant sensations offered by product.
Perceived quality	Subjective dimension, related to the opinion of each customer, influenced by specific aspects of the product.

Source: Garvin (1984)

Already thinking exclusively about services, Parasuraman et al. (1990) proposed a different set of dimensions for quality, presented in Table 5.

Table 5 – Dimensions of quality for services

Dimensions	Concept
Tangible aspects	Physical evidence of the service, appearance of the facilities, people, materials, objects and tools.
Reliability	Consistency and demonstrated ability to provide service.
Responsibility	Willingness to help the customer and promptly provide the service.
Competence	Specific skills and knowledge necessary to perform the service.
Courtesy	Finesse, respect, consideration and kindness in personal contact.
Credibility	Trust, honesty and integrity transmitted by the service provider.
Safety	Absence of risk, danger or doubt.
Access	Proximity and ease of contact.
Communication	Keep the customer informed in a comprehensible manner and listen to him.
Client knowledge	Effort to know and meet their needs

Source: Adapted from Parasuraman et al. (1990)

To this set of dimensions for quality in services, Rotondaro and Carvalho (2006) also added speed, seen as the one to start and execute the service, and flexibility, such as the ability to change the service when needed.

As for a typology of the services, Silvestro et al. (1992) proposes three broad categories:

a) Mass services, little customisation, with a high degree of standardization, serving large number of customers per unit of time, such as urban transport, television stations, hypermarkets, etc.

b) Service shops, those which serve an intermediate number of customers, with some contact and interaction with these customers, with a sharing of activities in direct contact (front office) and rear activities (back room), as the general retail, hotels, restaurants, hospitals, etc.

c) Professional services, with specialized activities and high contact with customers, highly adapted to their needs, such as law firms, doctors, consultants, architects, etc.

On the other hand, analysing the problem of quality of retail services, Costa Neto e Silva (2007) considered the need to subdivide the customer perception of quality of this type of extremely generic service into two components: the quality of the product (or service) that is associated with the sale by retail, and the quality of service provided, evaluated by other proposed dimensions by Parasuraman et al. (1990).

This analysis led to the construction of Figure 1, in which are the likely consequences of combinations of levels of quality of the two components of the service.

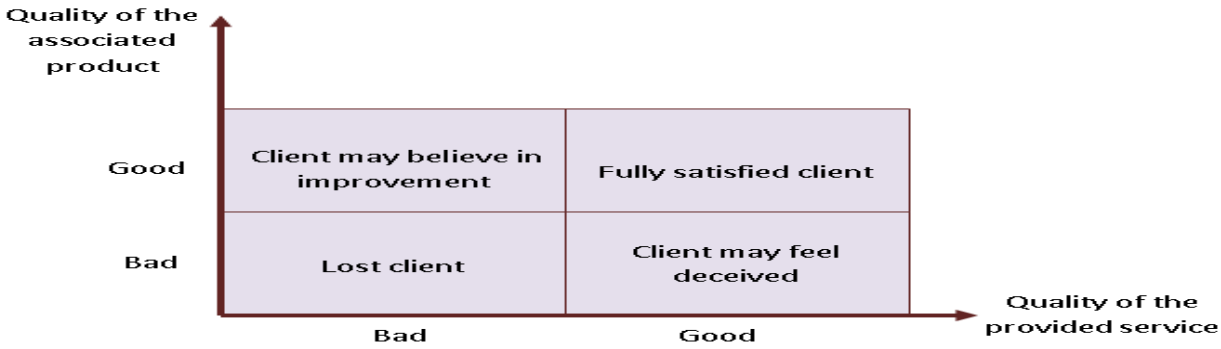

Figure 1 – Quality of provided service x quality of associated product. Source: Costa Neto and Silva (2007)

2.3 Views from experts focused on projects

The quality of the project is crucial to the final qualification of the product, for both functional and financial performance, and the factors that affect this quality are connected directly to the entrepreneur (ability to clearly express the objectives to be achieved), designer (ability to translate the goals and constraints on alternative technological functional solutions with equivalent performance), performer of the project (the ability to run the project without affecting the level of design quality) and systematized operational control (availability of legislation, documentation, rules, standardization) (HINO, 2001).

Several authors reflected upon aspects of quality relating them to project activities. For Campo (2004), the pursuit for project quality goes through the following actions:

- Dedication to the job definition.
- Understanding of customer requirements.
- Processing of customer requirements in documentation.
- Planning concept of "do it right the first time".
- Use tools for monitoring and evaluating the process.
- Continuously improve.
- Change the plans for "baselines" for that is a pattern of actions and changes.

The quality management of projects, according to the PMBok, involves three phases:

- Quality planning, which defines the basic patterns for the desired quality for the project and the means to achieve them.
- Quality assurance, involving actions that ensure the fulfilment of all its stakeholders' expectations.
- Quality Control, in order to ascertain whether the planned quality standards are being executed and promoting actions to resolve possible discrepancies (PMI, 2008).

This trilogy, if compared with that proposed by Juran (2002) for general quality – planning, control and improvement – presents the distinction that the improvement of the quality does not apply as in the case of repetitive processes, because the project is, in principle, unique. However, improvements in planning can – and should – be considered included in quality control activities and shall be analysed and applied wherever possible.

According to Maximiano (2010), the administration of project quality is the result of the quality of its elements: scope, time, costs and risks, among others. The same author discusses another important aspect linked to the issue of quality in projects, when considers two important and distinct faces of this quality: the quality of its management and the quality of the product(s) of the project, related to the appropriate use of this(ese) product(s) by the final customers, as illustrated in Figure 2.

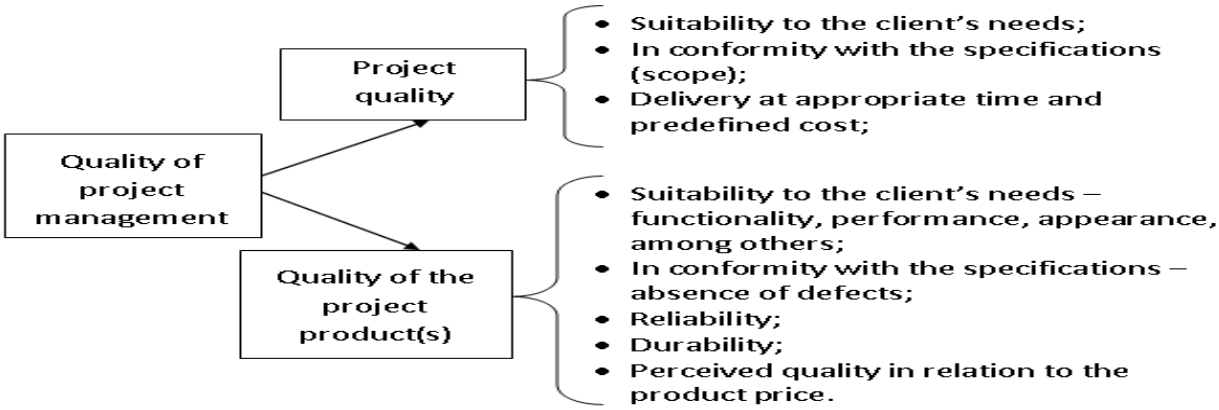

Figure 2 – The two aspects of quality of projects management. Source: Adapted from Maximiano (2010)

This dichotomy is conceptually similar to the one pointed to in 2.2 for the concept of quality when applied to retail services, as illustrated in Figure 1, with the aggravation that if a project is poorly managed and, consequently, poorly executed, this fact should cause negative impact on the quality of the project product(s).

3 Discussion of aspects relating to project quality

3.1 Typology of the product project

Now turning to the question "Is a project a product (tangible) or a service?", we fall in the same discussion presented in 2.1. Using those same arguments, the most likely answer will be "neither one nor the other", which leads to typify projects in the same category in which Juran classified software. In fact, like software, a project only makes sense if designed for later use, having physical properties, enshrined in a series of documents, specifications and procedures, which will approach a tangible product, but its characteristics for the realisation of the project product(s) are closer to those of a service.

Our proposal, therefore, is to consider that the third category of products according to Juran refers directly to projects, what is not against the collocation of the eminent thinker of quality because, ultimately, obtaining software is the result of the completion of a project.

On the other hand, an evaluation of the projects typology according to the classification of Silvestro et al. (1992), seen in 2.2, tends to frame the project activities, although it may be small, medium or large, in the category of professional activities, by requiring, in general, high specialization and the necessity of meeting the specific needs of each clilent. This clilent, in principle, is the client of the project, i.e., the one who commissioned the project and, only indirectly, the customers of the project product(s), as discussed in 3.2. Thus, for example, it may be a major engineering project to build a subway line, which will have many individual customers when the work is completed, setting up a mass service, but the execution of the project is highly professional, requiring industry experts with authoritative knowledge, seeking to

define the specifications to be met in close contact with the client of the project (the company or the Government concerned in the work) and provided with adequate competence required to generate properly the instructions and procedures to be followed in implementing the project and the use of the project product(s).

3.2 Aspects of projects quality

For the purpose of this discussion, is invoked the subdivision presented in 2.2 and represented in Figure 1, in which we differentiate the quality of retail service itself and the quality of the associated product(s).

Similarly, let's consider, in the case of projects, the quality of the project itself and the quality of the project product(s), as already used in Figure 2. This leads to the consideration of the existence of the project client(s), the one(s) that order the project from those who execute it, and clients of the project product(s), henceforth referred to as "consumers". These, in our view, are covered at the bottom of Figure 2. However, these consumers will also be indirectly being addressed when satisfying the needs of the client's of the project, because it is thought that they want good quality for the project itself so that the project product(s) meet the needs of the consumers, in many cases also customers of whom commissioned the project. These considerations also apply for conformity with specifications from the scope of the project, and for its on-time delivery and predefined cost.

Making these considerations, we can build Figure 3, which summarizes the likely results of possible analysis between the quality of project itself and the quality of the project product(s).

Figure 3 - Project quality x quality of the project product(s)

(1) Project client(s) and consumers of the project product(s).
(2) In the case of compulsory use of the project product (public transportation, hospital, etc.)
(3) Since if a good project is not generating good product(s), it must be due to some identifiable and repairable circumstances.

In addition, for the quality of project itself, translated by their conformity with specifications (scope), to be effective, we need quality in project management. Figure 4 presents the relationships related to these questions.

By examining now the approaches of quality presented in Table 3, they apply to the problem of the projects as follows:

- The transcendental approach relates to exceptional, unique designs, with demand for extremely high quality in its design and development, without which there would not lead to success. Example: the Apollo Project, which put a man on the moon.
- The product based on approach refers to projects that have special characteristics to meet the specific needs of certain groups of customers. Example: the design of a jeep to be used off-road.
- The user-based approach relates to projects whose product(s) search to satisfy the need for large numbers of people. Example: the design of a subway line.
- The process-based approach, already invoked earlier in this item, may be considered at two levels: in the design phase, the project specifications properly translate its scope and, at the stage of

project execution, this is to be conducted fully in accordance with the specifications. Tragic counterexample: the accident of line 4 on the São Paulo metro system.

- The approach based on value refers to projects that seek to meet its scope at a cost accessible to theinterested parties. This conceptualization can also be considered at two levels, in the project itself and in the project product(s). Example: The construction company Método Engenharia, when it was dedicated to the construction of residential buildings, rather than conceiving appropriate projects for the existing ground, with the respective quality requirements, it developed a standardised design and sought to acquire land that was suitable for this project and, as a consequence, cheapen the cost to the buyer of apartments.

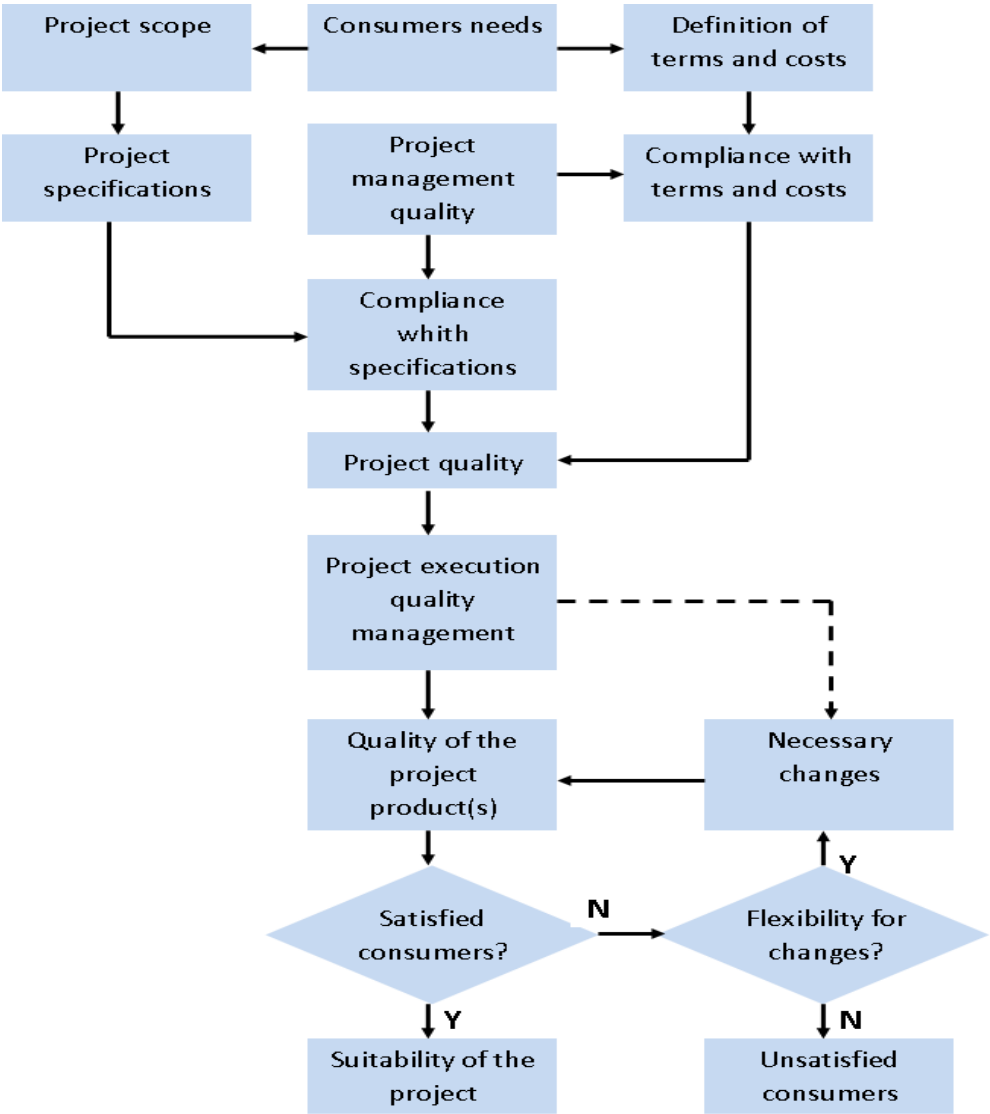

Figure 4 – Quality project and its management.

Examining further the dimensions of quality of products proposed by Garvin (Table 4) and services, proposed by Parasuraman et al. (Table 5), complemented by Rotondaro and Carvalho (2006), in Tables 6 and 7 are given assessments of the importance of these dimensions for the project and for the project product(s), using the notation: VI = very important; I = important; NA = not applicable.

In Table 7 the column corresponding to the project product(s) was not presented for being, in this case, this(ese) product(s) actually service(s), and their quality dimensions, as designed by the referred authors, deal basically with attitudes and behaviours of persons providing the services and not with service project specifications, object of discussion in this article.

Table 6 – Dimensions of quality for products in projects

Dimensions	of the project	of the project product(s)
Performance	VI	VI
Complements	NA	I
Reliability	VI	VI
Conformity	VI	VI
Durability	NA	I
Technical assistance	NA	I
Aesthetics	NA	I
Perceived quality	I	VI

Table 7 – Dimensions of service qualities in projects

Dimensions	of the project
Tangible aspects	**NA**
Reliability	VI
Responsibility	NA
Competence	VI
Courtesy	NA
Credibility	NA
Safety	NA
Access	NA
Communication	I
Customer knowledge	I
Speed	I
Flexibility	I

Observing in Tables 6 and 7 the columns concerning to project dimensions, it may be seen that the important dimensions and not applicable ones are distributed fairly well balanced in both classifications, which reinforces the idea that the projects do not fit easily in the categories "tangible product" or "service", justifying the proposition done in 3.1 is of including them in a third category. Some additional considerations make sense regarding the interpretation of the quality dimensions considered:

a) **Dimensions of products quality**

- **Performance**: means the project meet the purpose for which it was conceived. It should be noted that the main indicator of the effectiveness of this dimension is given by the proper performance of the project product(s).
- **Reliability**: regarding the project, means the absence of flaws in its design; for the project product(s), also includes safety and absence of risks.
- **Conformity**: already previously discussed.
- **Perceived quality**: is important for the project, by its direct client(s), but more importantly by the consumers of the project product(s), because its perceptual evaluation of this product(s) or service(s) will determine or not the business success.

b) **Dimensions of service quality**

- **Competence**: executing team characteristic that ensures the project's reliability.
- **Communication**: is important to ensure the correct capture of client's needs for proper configuration of project specifications.
- **Client knowledge**: contributes to the communication and allows a better dialogue with the clilent to improve the project.
- **Speed**: concerns the ability to complete the project within the period prescribed; applies also to the implementation of the project and is an often critical point.
- **Flexibility**: refers to the possibility of carrying out changes in the project without major problems.

4 Conclusions

In this article it is sought to deepen the discussion on the meaning of quality in projects, in the light of conceptualizations and quality dimensions devoted by literature. Given the generally accepted dichotomy between tangible products and intangible services as objects of production systems, it is shown that projects must be placed in a third category of achievements, previously distinguished by Juran (2002) with reference to software. The clue given by Juran was the main light given by the used references and nothing more was found related with the ideas developed in this paper.

For the purpose of deepening the analysis, it was invoked the vision of Maximiniano (2010), which covers two aspects of quality management of the project, concerning the quality of project itself and the quality of the product(s) of the project. It was also evaluated the importance of the dimensions of quality proposals by Garvin (1984) and Parasuraman et al. (1990) when applied to projects.

It is expected to be brought with this paper contribution to the conceptual discussion of the meaning of quality in projects. We imagine that other works related with this article may explore special types of projects and also the checking of its ideas against aspects of projects stated on PMBok (PMI, 2008).

This article is not given as closed, and may in future be identified dimensions for quality of project, as well as a number of dimensions or characteristics associated with quality goods and services. The authors put themselves at the disposal of those interested in deepening the analysis of this interesting question.

References

Campos, V. Falconi (2004). Controle da qualidade total (no estilo japonês). Belo Horizonte - Brazil: INDG, 8ª ed.

Cerquinho, F. (1994). Ética e qualidade nas empresas. Dissertação de mestrado, Escola Politécnica da USP, Departamento de Engenharia de Produção, São Paulo - Brazil.

Costa Neto, P. L. O. (2010). Administração com qualidade. São Paulo - Brazil: Blucher.

Costa Neto, P. L. O. (2007). Sobre o conceito da qualidade. XXVII ENEGEP – Encontro Nacional de Engenharia de Produção. Foz do Iguaçu, PR - Brazil.

Costa neto, P. L. O. (2007). Qualidade no varejo. XXVII ENEGEP – Encontro Nacional de Engenharia de Produção. Foz do Iguaçu, PR – Brazil.

Garvin, D. A. (1984). What does "Product Quality" really mean. Cambridge, USA, Sloan Management Review, Fall.

Garvin, D. A. (2002). Gerenciando a qualidade: a visão estratégica e competitiva. Rio de Janeiro - Brazil: Qualitymark.

Hino, M. K. (2010). Qualidade do projeto de empreendimentos habitacionais de interesse social: proposta utilizando o conceito de desempenho. Escola Politécnica da USP, São Paulo - Brazil. Available at http://publicacoes.pcc.usp.br/PDF/BTs_Petreche/BT303-%20Hino.PDF.

Juran, J. M. (2002). Qualidade desde o projeto. São Paulo - Brazil: Thomson Learning.

Maximiano, A. C. A. (2010). Administração de projetos: como transformar idéias em resultados. São Paulo - Brazil: Atlas.

Parasuraman, A. (1985). A conceptual model of service quality and its implications for future research. Journal of Marketing.

Parasuraman, A. (1990). Delivering quality service: balancing costumers perceptions and expectations. New York: Free Press.

PMI – Project Management Institute, PMBO of Knowledge (2008). Gestão de Projetos - PMI. Available at: <http://www.ebah.com.br/content/ABAAABH5oAJ/pmbok-2008-portugues>, access on: 12th August 2010.

Rotondaro, R. G. (2006). Qualidade em serviços. in Carvalho, M. M. e Paladini, E. P. (org.) Gestão da qualidade: teoria e casos. Rio de Janeiro - Brazil: Campus Elsevier.

Silvestro, R. (1992). Towards e classification of service processes. International Journal of Service Industry Management, v. 3, nº 3.

Withers, B. (2000). Does ISO 9000 Certification affect the dimensions of quality used for competitive advantage? European Management Journal, vol. 18, nº 4.