QUALITY MANAGEMENT OF ACADEMIC RESEARCH PROJECTS

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Abstract — *Researches which are undertaken in Academic environment can generate diversified results as Scientific Reports, Articles, Monographs, Dissertations, Thesis, or other related documents. Prototypes, models, software, patents, etc. can configure related results. With a view that these results are part of scientific researches and constitute an organized formalization of controlled actions, it should be considered as a Project per se. Therefore, the issue of quality of these results are addressed accordingly the fundamentals of Project Management and specifically of Quality Management. Thus, the presented paper is undertaken from principles of PMBOK® Guide, and describes the processes related to the Quality Management for an Academic Research Project. With this approach, it is expected to contribute with elements that can be added to or adjusted on academic contexts, in order to facilitate the research planning and developing of Academic Research Project as well to define quality metrics for this kind of Projects.*

Index Terms — Academic Research Project, PMBOK® Guide, Quality Management.

INTRODUCTION

Researches that are conducted in an Academic Environment are guided by an idea that is originated in an area, or more specifically in a Research Area. The structure of what will be researched, how and why, represents a relevant instrument in the Academic Research Area, as the formalisms proposed by an Academic Research Project.

For the people involved in the academic research environment, the project sometimes is intrinsic to the research itself. It represents part of the research activities and sometimes these are interchangeable and can be confused. There are other cases where projects are treated as part of the research methodology, and can be difficult to define exactly what the Methodology is, and what is the Project, leaving the formalism and conception of the Project, incorporating it directly to the Methodology.

However, some studies as seen in [1] presents in a detailed view the different steps and possible deliverables of a research project in the academic environment. Considering specifically an Academic Research Project, with its peculiarity characteristics, can comply with the definitions and practices of project concepts.

A group of people can be involved in the realization of an Academic Research Project, but in the project design phase, in some cases, these people are restricted to a Advisor-Professor and one Advisee (student involved in the Scientific Research). The Professor is the advisor of the project and the research, since it takes place in an Academic Research Environment.

At the end of the design phase one of the deliverables to be presented refers to the Project Charter as verified in [2]. However, there are other specific deliverables for the management of Academic Research Projects such as the Research Advisory Breakdown Structure as can be seen in [3] and the Academic Research Project Plan as mentioned by [1]. Other supporting deliverables can be checked in [1] to encourage the management of this type of project.

However, like other projects, an Academic Research Project should also consider practices relating to the Quality Management, or define how to approach the processes of Quality Management in an Academic Research Project as quality control and quality assurance processes.

In this sense, to detail the aspects of Quality Management for Academic Research Projects, this paper is considering the following sections: section two, to present in more details the components of an Academic Research Project; section three which deals with general concepts about Quality Management; section four that considers the Quality Management processes according to the PMBOK® Guide; the fifth section showing the relationship of the Quality Management processes and the Academic Research Projects; and, finally, section six, which features a conclusive view and makes suggestions for future research on the subject.

THE ACADEMIC RESEARCH PROJECT

A project is intended to establish formal activities to deliver a product or a service, sometimes considered generally as a result. Accordingly to [5] a project is a set of integrated activities in a given period that is able to design a product, service or a result.

The academic projects also must be considered as the same, i.e., it is performed in an Academic Research environment to deliver some result. It should produce the results on the Research Area defined on the Academic

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Research Project Plan to generate a product, a service or a result overall.

According to [7], a Research Academic Project reflects the formalized specifications about a research that will be realized considering the expected results and conclusions. The project is the means by which formalizes the research, it details the activities, needs and goals so that this can be accomplished.

Reference [8] considers the Academic Research Project to develop a Monograph, a Dissertation or a Thesis as well it is an instrument prepared by the student to qualify the proposed research in a Qualification Examination Session. It is a statement of intent organized in order to be evaluated in one session, generally known as the Qualification Examination Session of the research.

For the same author the research qualification certifies the first labor phase, i.e. the planning of the project that will be followed by the Execution Phase conducted by research activities as lectures, studies, investigations, laboratory testing, applications development, etc.

Therefore, the project cannot simply be confused with the act of 'designing' a research. The project should consider appropriate actions to any research cycle, from conception to delivery of the final results, which sometimes culminates with the presentation of the results for a group of people (Professors) who are organized formally in a meeting to review the results achieved with the research generally called the Research Defense Session.

The Academic Research Project should consider the same process groups taking place in the PMBOK® as verified in [5], they are: Initiation, Planning, Execution, Monitoring and Control, and Closing. These are process groups that must organize the tasks and activities for the realization of an Academic Research Project.

These processes are carried by groups as can be seen in Figure 1.

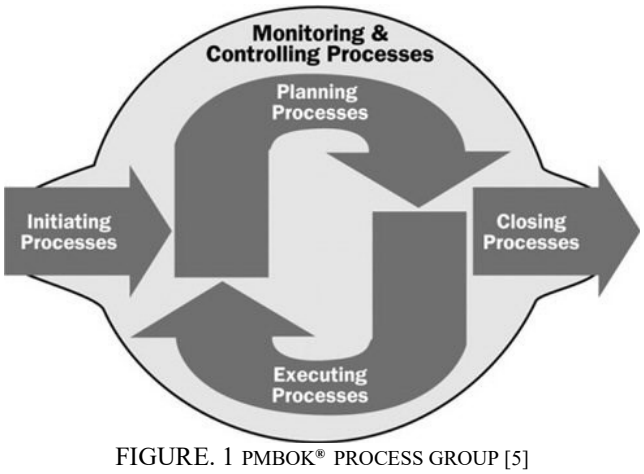

FIGURE. 1 PMBOK® PROCESS GROUP [5]

From the group of Planning Processes, where the Academic Research Project Plan should be prepared, the phases of 'Execution' and 'Monitoring and Control' should be realized and the concepts and techniques established in the Scientific Methodology should be attended as proposed in the Academic Research Project Plan.

Reference [1] presents a proposal for a major deliverable of an Academic Research Project that is the Academic Research Project Plan considering all deliverables to formalize the Research Project and actions to the Project Planning.

However, an Academic Research Project does not finish with the construction of the Academic Research Project Plan. The realization of research corresponds to the group of processes 'Execution' as verified in [5]. While the project is undertaken the 'Monitoring and Control' processes should also be undertaken to assure the Project Monitoring and Control.

In an Academic Research Project, the Researcher usually represented by a student (depending on expected result, i.e., a Dissertation, a Thesis, a Scientific Technical Report, etc.), the Advisor- Professor responsible by viability of the project, can be considered as the key project stakeholders. In general the projects are carried out under an Academic Structure that comprises a group of people dealing with administrative and scientific aspects, so in this case, the Coordinator of this group also happens to be one of the stakeholders of the Academic Research Project.

Reference [8] also considers that the Customer or End-users of the results of the Research Project should be deliberately elected by the student favoring the definition and objectives of your project. He also has to be considered as one key Stakeholder.

The relevance that must be considered by the major project deliverables as [5] correspond to the Research Advisory Breakdown Structure that specify the Project Scope and other characteristics of the project and the Academic Research Project Plan. As [2], a Project Charter of an Academic Research Project should be prepared using a specific template for an Academic Research Project named Research Advisory Breakdown Structure.

The Scope Specification of an Academic Research Project can be realized considering the Research Advisory Breakdown Structure (RABS) an instrument that enables the analytical framework of Academic Research Project, as shown in [3].

Finally, the project deliverable that should be considered as the principal feedstock for the project realization, i.e., the Academic Research Project Plan as can be verified in [1], should be built from a series of subsidiary plans coming the various knowledge areas pertaining to the Project Management Fundamentals, as the Quality Management that is the subject of the following sections.

QUALITY MANAGEMENT APPROACH

There are varied prerogatives to manage a project especially as it pertains to Quality Management. There are common

expressions to this subject such as: 'quality control of the project', 'ensure quality', 'consider the time, cost and quality of the project', that relate the project result and its quality.

Back to quality or to the Quality Management, when seeking to observe the Project Management Fundamentals, is a relevant practice that is considered by specific frameworks for Project Management as the PMBOK® Guide.

Subjects related to quality or the Quality Management within the Project Management issues are treated in a manner that seeks to plan and manage the quality, either of the project itself or the result of this as the product or service being delivered.

A project has its own lifecycle which differs from the product lifecycle. The scope of a project corresponds to how the project should be done as well as the product scope considers what should be done. The same way it is possible to consider, along the realization of the project, standards for measuring the project quality that differ from specific standards of product quality.

The quality of the project must link actions to ensure that the project is carried out within its limits, as established by those involved in the project. This involves taking into account the actions, procedures as set initially so that the project meets what was established. The quality in this sense must cooperate so that the set of project activities is completed according to the requirements and standards established for the specific project.

The quality characteristics of a product or a service are specific to this and should be noted according to specific standards and mechanisms for measuring a product or a service itself.

Thus, [6] suggests that the approach to Quality Management and the associated tools and techniques are dependent on the type of product or service.

Relevant aspects concerning to the Quality Management, according to [5], refer to the attendance to organizational policy and quality systems that should be observed and treated when performing a given project. The project shall carry out to promote the delivery of a product or a service, within the limits of the organization Quality Management practices properly defined by the organization. There are relevant factors in the Academic Research environment as quality standards that must be met during the conduct of an Academic Research Project.

The peculiar characteristics related to quality mean that for it to be verified as part of a project there should be specific standards to be applied in several projects of the same type or the same category, so the results can be checked and compared. Within a project, these standards are elementary for the quality assessment, i.e., the processes, procedures and standards enable the condition to promote and verify the project quality through the results disclosed.

The projects are conducted according to a set of procedures organized linearly or in parallel. These processes represent a set of activities to accomplish the project and these processes and activities are subject to measurement reflecting thereby the qualitative view of the project.

Is possible to consider a link between project quality and product quality, however this relationship is not necessarily true and sometimes it can be verified positive result for the project and negative result for the product delivered by the same project or vice versa. The project may have fulfilled the policies, procedures and scope, cost and schedule, but the product does not meet their expected results.

However the concepts and studies that exist pertaining to Quality Management in Project Management and the studies of quality processes according to the PMBOK® Guide favor their relation to the Academic Research Projects as treated in later sections.

THE QUALITY MANAGEMENT PROCESS DEFINED BY PMBOK®

For many researchers as [6], the quality within Project Management has the same importance as the scope, cost and schedule. The qualitative features that satisfy the Customers although are relevant to the results of any project but sometimes they are not materialized.

To perform Quality Management as defined by the PMBOK® Guide, three processes has to be considered for a project, as follow:

- Quality Planning,
- Quality Control, and
- Quality Assurance.

These processes are capable of supporting the project and generating activities in the moment of specific phases of the project as 'Planning'; 'Execution' and 'Monitoring and Control'. They are required to establish the Quality Management mechanisms in the project.

To [9], the Quality Control process should ensure that the product or result of the project satisfies what was specified and the Quality Assurance process should ensure that the procedures to be performed are able to deliver products that meet the specifications.

Quality Planning should be done along with other Planning activities in order to establish formal mechanisms to be considered in the Academic Research Project Plan and to formalize what is expected relating to quality of project results.

As mentioned, the quality of a project can be satisfactory since they met the criteria specified as it was realized on time, scope and cost according to previous estimative, but the product or service arising from the project could not meet the specifications, as well not reaching the expected quality.

The institutional or specific standards for a particular project within Academic Research Area should be defined in the Quality Management Plan. [11] takes the view that the entire project team must be aware of the Quality Management Plan, because only in this way the quality

guidelines of the project and their responsibilities will be followed.

To [10], during the Project Planning phase is relevant identifying quality standards for each product that will be generated during the Project Execution Phase as well as to determine the quality expectations of the product and the processes used in that project.

The Quality Planning of a project conducted under the Planning process group, according to the PMBOK® Guide [5], should be careful and formalized in the main deliverable of this group of processes, i.e., in the Project Management Plan, and in case of academic research projects in the Academic Research Project Plan, as proposed by [1].

Actions related to the Execution process group, processes should occur according to what is defined in the Academic Research Project Plan and should therefore attend to what is specified in the Quality Management Plan as criteria to assess the quality of both the project itself and the product or service specifically.

If institutional standards have been defined to measure quality, they must be attended and for doing that, the Quality Assurance Process that intersects precisely with the Execution process group must ensure the quality, ensuring that the steps of this process are followed and ensuring that the standards established in the Project Planning phase are in fact met.

Considering that in time of project development it must be constantly monitored and controlled to meet the Monitoring and Control process group as established by the PMBOK® Guide (see Figure 1), the process of Quality Control along with the other Monitoring and Control processes should be attended to demonstrate the Quality Control.

The project control may be performed in various ways, using many techniques and providing a set of reports. To [10], control should consider specific supervision with the aim of achieving total quality. A commonly used means of Quality Control is the audit, which considers specific techniques for presenting the results of project development.

QUALITY MANAGEMENT IN THE ACADEMIC RESEARCH PROJECTS

The processes of Quality Management should also be considered in an Academic Research Project and should be considered relevant actions to each of these processes to be able to carry out the project and delivery project results with quality.

Accordingly the considerations presented in the previous section regarding the Quality Planning, it is necessary to establish mechanisms that can assess the quality of the project and its results.

Regarding the standards, for example, to assess the project quality they should be treated accordingly to institutional policies and procedures, i.e., the qualitative characteristics of the project must meet the standards, rules and practices defined by the Academic Institution.

However, besides the quality of the project, the quality of the project results should be measured as well. Depending on the Research Area is possible that the Academic Research Project makes available to the end of the project two main results: 1) a Monograph, a Dissertation or a Thesis, for example, and 2) a product or service as a project result. The end result of the project, which may be, for example, software, a prototype model, etc. Thus these two final results must possess qualitative parameters to be measured.

The Monograph, Dissertation or Thesis as a result of an Academic Research Project, must have their quality parameters defined in the Quality Management Plan linked to Academic Research Project Plan accordingly to the Institutional Policies and Standards or specific parameters defined by those involved, especially by the Advisor.

However, in case of a Research Project that perform beyond the Monograph, Dissertation or Thesis any other result, such as software, for example, the quality parameters of the project result should be set in the quality plan. The parameters have to be well defined to be checked in time of Quality Control.

Sometimes the researcher's inexperience may hinder the election of standards and parameters to be checked to measure the quality of the project result, but the experience of the Advisor- Professor must be respected so that it can establish minimum parameters to be measured in time to perform the project and in time of Monitoring and Control. These parameters and measuring activities must be registered, in the Project Planning phase, more specifically in the Academic Research Project Plan.

Reference [8] suggests that the appropriate method for carrying out the research and treatment of the research question can be considered as a parameter to assess the quality of the project and this can be considered in the Quality Planning. The verification of quality parameters that were planned for the project coincides with the results of the Project Execution is the responsibility of the Quality Assurance process.

The parameters that measure the project quality itself and the Monograph, Dissertation or a Thesis as a project result must meet primarily to the institutional parameters and sometimes to the specific parameters of a specific project. However, assess the quality of the research itself; the content of a Monograph, dissertation or Thesis should be evaluated constantly by the Advisor-Professor and at the end by the others Examiners. However, in some cases where there is another result of the project, besides the Monograph, Dissertation or Thesis, there must be ways to measure the quality of this according to what was established in the Quality Management Plan associated with the Academic Research Project Plan.

Reference [8] argues that Quality Control has been modified in the Academic Environment following aspects of Quality Management that is currently given by the general

industry, also failed to consider the quality of a Research Project and their results only at the end of this (at the end of the project) when the results were assessed by the Examiners of the Research. Currently, better prepared, the Academy consider research more efficiently means to verify quality throughout the completion of the Research Project, considering for this, as an example, the Qualification Examination Session of the Research Project (adopted by many Academic Institutions). Also considering the role of a Co-Advisor, who can facilitate the conduct of research, among others.

CONCLUSION AND FURTHER WORKS

Research actions in the Academic field require organization, formalization and control which can be held according to the principles of Project Management. This paper shows how it is possible to apply these fundamentals to Academic Research Projects, emphasizing the aspects of quality and their related processes that can be applied according to specific standards defined to the project or institutional ones.

However, it is suggested that future research may provide some details on institutional standards that favor the measurement of quality of the results of a Research Project in an academic field, specifically if are considered as part of the results of this type of project a Monograph, Dissertation or a Thesis.

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