

# Contribution on the Efficiency of Doctoral Activities

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*Abstract:* The paper tackles the organizational problem related to the PhD activity both on departmental level and on each training program. The structural model of the PhD department and the function of a site with the role of sustaining the activities in this department are presented in a systemic way. For the individual PhD training program, the Project Management methodology is proposed to be used in order to improve the establishing of the training planning, research content, deliverables, activity scheduling, resource allocation, cost estimation and finally the writing of the thesis.

*Key- Words:* - PhD department, PhD training, project management

## 1 Introduction

Scientific research represents one of the main factors of the economic development of the society. Scientific research and the way it is carried out especially were looked at differently in different historical periods, geographical, political, economic, social and cultural areas.

The time when the researcher considered that it's impossible to give instructions on how to conduct a research activity is not far away. That was the time when the accent was on the art of the research and self-instruction. For sure, the art of the research remains important, but in order to obtain something “wished for” in an efficient way, it is indispensable to make not only a resource forecast and organization but also an initial identification of the human knowledge and abilities necessary for the desired research.

We shouldn't ignore the role of intuition (Albert Einstein) [1], or a possible failure (Charles Nicolee); it's obvious that “the discovery” is revealed to the one who is able to understand and receive it.

Science planning revealed many controversies, which started especially from the existence of two research types: pure and applicative.

Beveridge [2] shows three possible levels of research planning:

- The design and progress of the research;
- Planning for a longer period and for high coordinates of the research, which depends on its manager;
- Planning politics which depends on the organization or the structures that decide upon the research.

Beveridge insists that the research must be planned by the one who makes it.

Most of the times, the research is made in a team and problems with the team leader and his team may appear. The manager's abilities and team's characteristics are important in creating a good work atmosphere, required in order to obtain good results.

There will always be an algorithm to follow in a piece of research: the preparation stage with bibliographical study, problem (phenomenon) approach, planning, experimental design, hypothesis etc., where creative thinking, intuition, observation, reasoning, chance etc. have an important role.

## 2 Systemic model of the PhD department

Scientific research cannot be made without adequate professional training. Currently, PhD training finalized with the drawing up of the thesis is one of the main training forms for the high level researcher in a specific area. These activities are carried out especially in universities, being a level of the educational process with an important role in improving the scientific standards of universities.

The PhD department must be organized on the strategic management bases in order to attain its mission of being promoter of the scientific research.

The mission of universities is to educate specialists in different areas, capable of using scientific, technical, cultural and spiritual knowledge in order to fulfill the technological, economic, social and cultural status of the world.

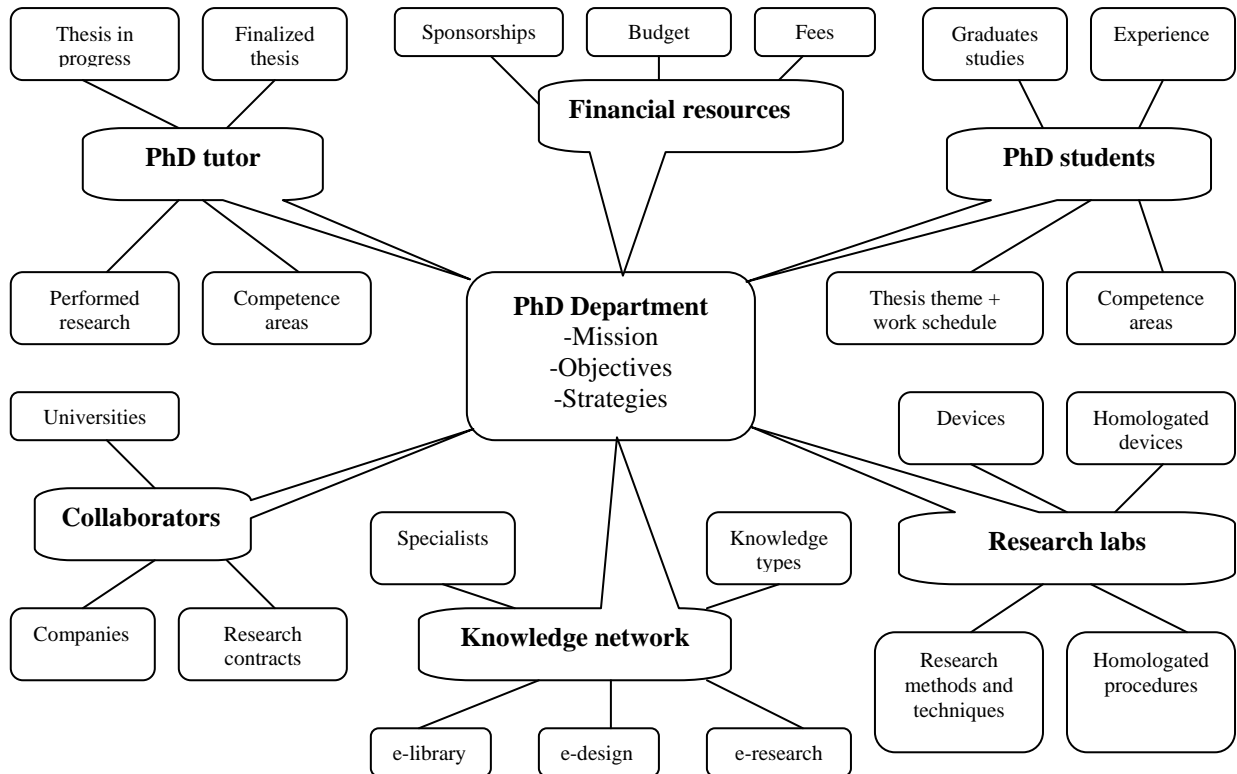


Fig.1. Structural model of a PhD department – information available on site

The growth in the number of PhD students, the improvement of the qualitative level of their studies and a correlation between the research topics, the university strategy and market needs represent the purpose of the doctoral centers (PhD departments).

A high level PhD activity can be carried out only in correlation with the world research dynamics. A SWOT (strengths-weaknesses-opportunities-threats) analysis is absolutely necessary in order to sustain this correlation. Starting from the SWOT analysis, permanent actions will be taken by objectives and strategies proposals that will be followed and finalized with a view to being in accordance with society dynamics.

The structural systemic model of a PhD department is presented in figure 1. The basic structure of the department is focused on the mission (established by the university), objectives and strategies. A key element is the existence of the PhD advisors. For every advisor it is necessary to identify: competence areas, research conducted, PhD theses drawn up under his guidance, finalized PhD theses. The research laboratories existing in the university represent an important aspect, which sustains the value of the research activities. There are included devices, homologated devices, types of

possible measurements (homologated procedures), research methods and techniques. External collaborators and the knowledge network sustain the university research. Last but not least, it's necessary to know the financial problems (fees, budget, sponsorship, estimative research costs, etc). If these problems are presented on a web site, the future PhD students can choose a PhD advisor, they can establish the research area, the necessary competence of the PhD student and the PhD research activity can begin.

Taking into account the hardware and software facilities, the PhD department can present the information on a site. A PhD training program can begin, as presented in the following methodology.

- PhD department web site access;
- Access to the data base of the PhD advisors; There are included information on names, competence domains, research conducted, PhD theses advised, finalized PhD theses;
- On line contact between the future PhD student and PhD advisor;
- Registration to enroll in the PhD training program;

Table 1 Plan of the argument (example)

One sentence for each aspect	Example
Introduction (area of the study)	Necessity determination of the producers and users of profiled cutting tools with helicoidal canals
The problem (that I tackle)	How, who, where can such cutting tools be made? What about market needs?
What the literature says about this problem	Theory related to the determination of the cutting tool profile contains generating methods, previous results, difficult and unsolved problems related to the complex profiles with minim errors, the use of CNC machine tools with several axes and modern tools.
How I tackle this problem	Starting from the necessity of manufacturing very precise cutting tools, mathematical models and specific software will be realized
How I implement the solution	The software will be implemented on a CNC grinding machine tool with several axes.
The results	The profile precision will be improved; better geometry will be obtained; the reconditioning process will not introduce errors.

- Exam
- Choice of the thesis title and first general content;
- The PhD advisor points out the student's knowledge and abilities necessary to complete his thesis;
- Choosing the topics for the exams and preliminary paper;
- Setting work priorities, necessary resources and work methodology.

### 3 PhD Research

A PhD research in fact an exercise, in which the PhD student shows his own capacity of:

- Formulating a research problem;
- Performing scientific research;
- Being able to communicate and cooperate with scientists from different disciplines near his/her own field of research;
- Participating in scientific discussion on an international level;
- Being able to write papers in international refereed journals.

If we analyzed the research process over time, we could see that there are four distinctive stages, each of them having several steps. These are:

- Preparation stage which contains: documentation, situation analysis of the key areas, provisional option related to the key areas, proposal related to the key areas, and finally establishing the key areas.
- Establishing and planning the objectives: analyzing the existing situation, establishing the objectives, performance standards, the

necessary abilities and the guide for the objective leader

- The execution stage contains: work in order to attain the establish objectives, provisional evaluation of the performances, objective revision, decisional and technical assistance, control, reward.
- Comparison, evaluation and reward stage

We can mention that the general trend in the research activity implies the use of the Internet (e-design, e-research), relations between different research and design centers and relations between universities. All these aspects develop due to the information technology, electronic and communications facilities and sustain the globalization process, European integration process regional integration, etc.

The development of Internet design and research allows the access of PhD students (generally of all researchers) to the best resources in the world (knowledge, devices, experiences, etc.) through the modern knowledge networks available between universities, research centers and industry, based on partnerships.

In the case of PhD training, the first period is an educational one which consists of specific courses, exams and preliminary papers drawn up in the area of interest.

After the exams and preliminary paper, an argument plan [6] will be the starting point for drawing up the thesis. An example of such plan is presented in table 1.

The aim of a PhD training program is the writing and evaluation of the PhD thesis in a well-defined period of time with limited resources and observing some legislative regulations.

Table 2 Structure of the PhD research, analyzed through Project Management methodology

Chapter i	Deliverable i1	Activity Ai11	workpackage Wi11
		Activity Ai12	workpackage Wi12
		Activity Ai13	workpackage Wi13
		...	...
	...		
	Deliverable ij	Activity Aij1	workpackage Wij1
		Activity Aij2	workpackage Wij2
		Activity Aij3	workpackage Wij3
		...	...
	...		

Table 3 Example of the PhD research planning, analyzed through Project Management methodology

Deliverable	Activity	Work package content
Experimental research	Prepare the installation for experiments	Machine tool; Cutting tools Estimated duration Necessary human resources Necessary knowledge and abilities
	Prepare the samples	Materials for experiments Duration of samples cutting Human resources - knowledge and abilities
	Make the experiment and notice the results	Duration Human resources - knowledge and abilities

We propose the use of Project Management methodology in order to plan efficiently the entire PhD training program.

After the argument plan is made, in the specific situation of each thesis, the deliverable will be established depending on the research type (fundamental, theoretical, applicative) and on the expected results. In the following, some possible steps with the correspondent deliveries are presented [4].

- Bibliographical results;
- “Actual stage” elaboration;
- Finding the specific area you want to study.
- Identifying the aspects you want to study from the point of view of the “expected results”. Identifying the necessary research deliveries.
- Establishing the necessary activities for each delivery and notice the work packages.
- Following the plan and realizing the practical research activity.
- Grouping the information in chapters.
- Realizing the first content of the thesis.

This Project Management methodology starts from the expected results of the research problem.

Each main part of the studies will be contained in a chapter.

An example of the main chapters of a thesis is [3]:

- Introduction
- Review of the previous work
- Philosophy of approach
- Plan of attack
- Description of the work
- Critical analysis of the results
- Future work
- Conclusions

Each chapter will contain one or more deliverables as a result of the research work. Each deliverable can be reached by carrying out some activities. The success of each activity depends on the strictness of its planning which needs the defining of a work package.

The way in which the activities and work packages are established for each deliverable and then the way in which these deliverables will be included into the thesis chapters are presented in table 2.

In order to underline such a methodology we shall give an example in table 3.

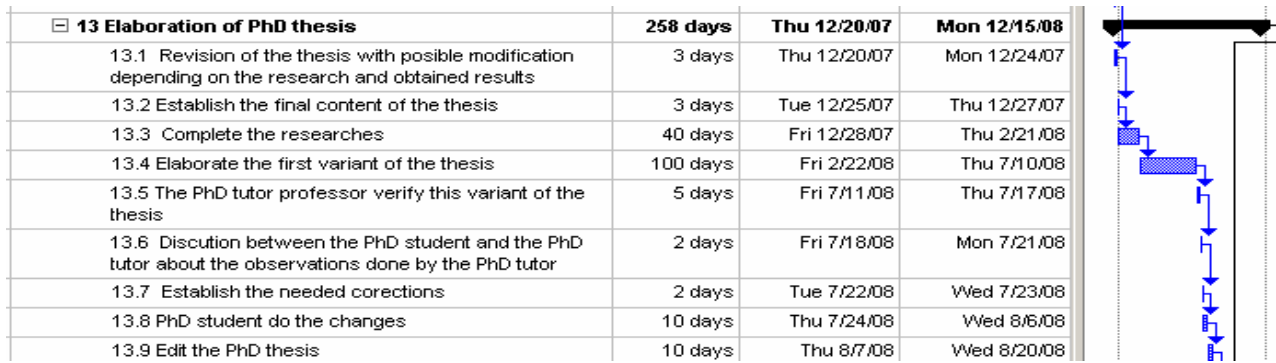


Fig.2. Part of the PhD planning analyzed through Project Management perspective

The necessary knowledge and abilities must be found in the content of the proposed exams. On the other hand, the activities that will be part of the research program and of the thesis too, must be found in the content of the four preliminary papers that must be drawn up in two years.

The research execution and thesis drawing up form the main part of the PhD training.

We propose the using of the Project Management methodology in order to improve the establishing of the training planning, research content, deliverables, activities, work package contents, scheduling, resource allocation, cost estimations and the writing of the thesis.

In figure 2, there is presented a fragment of the PhD program realized in Microsoft Project software using Management Project methodology.

#### 4 Conclusion

Internet use in carrying out and planning the activities from the PhD department and then the use of Project Management methodology for planning the individual PhD training program allow an efficient improvement of all activities, many of them being carried out on-line.

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