

## **SUMMARY OF THE PhD THESIS**

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**Thesis title: *EFFICIENCY AND PERFORMANCE OF UNIVERSITY SCIENTIFIC RESEARCH***

The elaborated thesis starts from the study of the concepts of efficiency and performance, their relation and peculiarities of this relation in the context of university scientific research, as well as the study of methods for measuring and evaluating the efficiency and performance. It approaches the evaluation of university scientific research according to the personnel employed in research, aiming to respond in this way to certain questions and problems identified in literature:

- what is the concept of the personnel employed in research concerning university scientific research;
- mitigate negative side effects that changes in the university scientific research management (laying the stress on research funding in terms of performance, quantitative evaluation of the performance, diminution of financial resources available for research) can have on research quality;
- elimination of noxious effects of the selection of inadequate evaluation criteria;
- finding a solution to the problem of weights (%) which each performance criterion should have on the evaluation of university scientific research.

The *goal of the research* includes two directions: (a) explore the profile of university scientific research activity at the “Grigore T. Popa” University of Medicine and Pharmacy of Iassy from the point of view of the academic personnel employed in research, (b) propose a system for measuring the efficiency and performance of university scientific research from the point of view of the personnel employed in research, which takes into account the scientists’ necessities and involve them in establishing the way of performance evaluation.

The material used in the thesis comes from an inquiry on a sample of 74 persons from the academic staff who carry out scientific research activity within “Grigore T. Popa” University of Medicine and Pharmacy of Iassy. Statistic processing has been performed by means of computer software and Excel and SPSS statistics.

The work is structured in five chapters, introduction, conclusions, literature and annexes.

**Chapter 1** is dealing with the problems of university scientific research, approaching the following aspects:

- the context of its appearance and development;
- functions of university scientific research (create the framework for the educational role of university; create new knowledge and adjust the knowledge to demands; stimulate the innovation within business environment; supply public counseling services; create and develop worldwide relationships);
- forms of university scientific research (basic research; applied research; experimental development);
- organization (*research structures existing within the universities*: institutes, centers of scientific excellence, centers of research or innovation and technology transfer; research departments, technological platforms and research laboratories, doctoral schools, circles of students' research; *organization of scientific research in the context of university- business cooperation*, under the form of innovative clusters or competitiveness poles; university-based business incubators; international research consortiums);
- factors of influence (processes by whose means one offers financial support, provides human resource development and stimulates the mobility and interactions).

**Chapter 2** presents the conceptual elements concerning the efficiency and performance of university scientific research, and it is organized on three sub-chapters, as follows.

The first sub-chapter is dedicated to the definition of efficiency concept, laying the stress on: etymology and its definition, concepts and theories shown off in literature in terms of efficiency, and forms of efficiency.

The second sub-chapter defines the concept of performance, presenting its evolution in time, approaching at the same time all its forms, individual performance and organizing performance, as well as some concepts related to performance. At the same time, it includes a short presentation of performance criteria and standards and the concept of performance evaluation.

The third sub-chapter tries to surprise the peculiarities of efficiency-performance tandem in the case of university scientific research, revealing the characteristics of efficiency-performance relationship, specificity of efficiency concepts in high education and scientific

research institutions, certain components and dimensions of the performance within the university scientific research, as well as the premises of the study of efficiency-performance relationship in university scientific research.

**Chapter 3** of the thesis is dedicated to the measurement and evaluation of the efficiency and performance of university scientific research. It includes two sub-chapters, corresponding to the two considered concepts.

The first sub-chapter refers to the problem of measuring and evaluating the research efficiency in university institutions, laying the stress on the main problems of concern: aggregation of inputs and outputs, the level of the analysis and methodological approaches (statistic approach, stochastic approach: Stochastic Frontier Analysis, deterministic approach-Data Wrapper Analysis).

The second sub-chapter treats the measurement and evaluation of performance in university scientific research, approaching problems such as the types of users of information coming from research performance evaluations, types of indicators, methods used in the evaluation of university scientific research performance (*Peer-review* methods; bibliometric methods; impact, methods to identify groups of research organisms with homogeneous performance; performance self-evaluation).

**Chapter 4** represents a study performed to determine a profile of the university scientific research at the “Grigore T. Popa” University of Medicine and Pharmacy of Iassy, from the prospective of the academic personnel employed in research. The accent is laid on the following topics: introducing the “Grigore T. Popa” University of Medicine and Pharmacy of Iassy (history, mission, legal regulation for the development of scientific research within the university, organization and realization of scientific research within the University, internal organisms of UMF Iassy that support scientific research activity); introducing the research methodology (goal and objectives of the applied research, research hypotheses, sample, questionnaire, utilized research methods and technologies); the opinion of academic staff on university scientific research; opinion of university staff concerning the organization of scientific research activity, factors of influence of university scientific research and the support and financing of university scientific research.

The *research hypotheses* verified within this study are:

- 1) There is a concordance between the opinion of the academic personnel about the university scientific research, and the University strategy related to university scientific research.

- 2) Academic personnel employed in research in universities thinks that the weight (%) of scientific research activity and the weight (%) of teaching activity should be equal.
- 3) Researchers are aware of the general objectives of the scientific research activity from the University.
- 4) From the standpoint of the academic personnel, research strategy of the University is in a straightforward relation with *National and international research programs*.
- 5) From researchers' standpoint, the *Competence level of the academic personnel* is the main factor of influence of the research priorities of the university where it performs its activity.
- 6) From researchers' standpoint, the *Availability of competences at the level of academic personnel* is the main internal factor that influences the research strategy of the university where it performs its activity.
- 7) Researchers know the main financing sources of the scientific research activity from the University.
- 8) Researchers' knowledge of the weight of the University budget allotted to research activity is positively associated with research result.

The results of the study shows that the academic personnel from UMF Iassy has different opinions about university scientific researches, the individual answers being diverse, approaching various dimensions of the concept and identifying only partially the elements of the opinion about university scientific research assumed by UMF Iassy. Yet, there are elements that show that the academic personnel employed in research at UMF Iassy is aware of how the research is organized and performed at the University, financing sources, possibilities to get funds for research, University's objectives with respect to research quality and priority research topics, but this information is not complete and not completely valid.

From the results of the study, one could validate the following hypotheses:

- *Hypothesis 3*, according to which: Researchers know the general objectives of scientific research activity from the University;
- *Hypothesis 4*, according to which: From the standpoint of the academic personnel, the research strategy of the University is in a straightforward relation with *National and international research programs*.
- *Hypothesis 5*, according to which: the *Competence level of the academic personnel* is the main factor of influence of the research priorities of the university where it performs its activity.
- *Hypothesis 7*, according to which: Researchers know of the main financing sources of the scientific research activity from the University.

**The last chapter** is dedicated to the problem of selecting the adequate evaluation criteria of research performance, and it proposes to build a system for the evaluation of university scientific research that takes into account two essential aspects: involves the researchers in the selection of the most relevant evaluation criteria, and set the condition for the performance compliance with the efficiency criteria, i.e. take into account the inputs-outputs relation in performance evaluation.

This chapter presents the input and output elements of the research activity selected from the opinions of the academic personnel to be part of the system, as well as the mathematic relations used to integrate into the system the concepts of efficiency,  $f(\text{output}/\text{input})$ , and performance,  $f(\text{output})$ . These relations reflect the researchers' choices concerning the criteria and their importance in the process of research performance evaluation.

The result consists in the determination of an equation of performance that uses performance criteria (as well as indicators that describe these criteria) chosen by the evaluated researchers. At the same time, criteria and their descriptive indicators are weighted in the model using the significance and relevance coefficients based on the options of the sampled academic staff.

*During the process of selecting the input elements of the system from the standpoint of the employed research personnel*, the academic personnel has confirmed in percentages of 64.4% -91.8% the adequacy of the input elements of the proposed research activity (Human resource; Knowledge of university academic personnel; Financial sources; Research infrastructure: equipment, laboratories, etc), and in percentages of 51.4%- 86.1% the relevance of the indicators listed in the questionnaire for the description of the selected input elements (Funds invested by the University in its own research infrastructure- 86.1%); Number of doctorate coordinators - 69.4%; Funds invested by the university to support the research in priority domains strategically assumed at national level- 65.3%; Number of subscriptions to specialty magazines (paid by university) – 51.4%).

*During the process of selecting the output elements of the system from the standpoint of the employed research personnel*, almost all of the respondents (97.3%) have indicated *the Results obtained in the research activity* as a criterion for the performance evaluation of university scientific research. *Recognition by the academic community* and *Financial resources drawn up for scientific research* have been mentioned by about two thirds (64.4% and 63% respectively), while the *Scientific research environment* has been appreciated as criterion for performance evaluation of university scientific research by a little above one third (37%) of the respondents.

All the six indicators proposed for the evaluation of the results obtained in the scientific research activity have been considered as adequate by at least 50% of respondents.

It is worth mentioning the indicators *Number of publications quoted by ISI Web of Knowledge* and *Number of papers indexed by ISI Web of Knowledge*, which were selected as representative for the results obtained in the university scientific research by 95.9% % and 85.1% of respondents, respectively.

From the list of indicators proposed to the academic personnel for the evaluation of scientific research environment (*i.e. number of recognized researchers and young researchers drawn through university programs, number of organized scientific manifestations of international level; number of graduates of doctoral studies*). The lowest number of positive responses corresponded to the number of graduate doctoral students, which can suggest that the newly formed doctors, i.e. future researchers, are not considered at this moment as a strong resource in the realization of a performing university scientific research.

Each of the nine indicators proposed for the evaluation of the recognition in the academic community have been considered as relevant by more than 50% of respondents.

The highest weight belongs to the number of quotations (93.2%), number of members in the board of magazines quoted by ISI Web of Knowledge (82.4%), and the number of national and international awards and distinctions (78.4%).

For the evaluation of the financial resources drawn up for scientific research, the questionnaire gave the researchers the possibility to express their opinion about the relevance of five indicators, the funds drawn up through national competitions, and funds drawn up through international competitions being selected as adequate by 97.3% of respondents.

Since the proposed input-output system for performance evaluation has been built from the standpoint of the personnel employed in research, the output elements whose sum represents the performance, as well as the input elements involved in efficiency determination, have been weighted reporting them to the weight of respondents who considered them as relevant in the description of research performance and efficiency, as well as to those coefficients of significance assigned by respondents to each element.

By replacing in the general formula of the model, the coefficients' values determined through inquiry, one obtains the following equation of performance:

$$\begin{aligned} & \text{Score of the research structure performance} = \\ & = 0.43785 \text{ Results} + 0.1288 \text{ Recognition} + 0.126 \text{ drawn up Resources} + 0.0555 \text{ Environment,} \end{aligned}$$

in compliance with the condition that the efficiency of the research structure (i.e. the ratio between the obtained output and the input used by the research structure) is maximum.

The proposed evaluation system brings together the advantages of the self-evaluation and peer-review methods, by implying the researchers in the evaluation process (in establishing the relevant indicators for research performance and in determination of relative significance of these indicators in the overall research performance) and of the bibliometric evaluation methods, by including several bibliometric indicators in the set of primary performance indicators.

At the same time, the system responds to the requirement of research efficiency, as it assumes the maximization of performance score and of the output/input ratio (as an expression of efficiency), by the fact that the researcher chooses himself the criteria in terms of which to be evaluated, and the importance of each criterion in the final score.

What concerns *the limits of the proposed evaluation system*, one can mention the existence of a certain degree of subjectivity, derived from the freedom of researchers to choose the weights, as well as from the potentially high cost (from both financial standpoint and the time involved) required by the realization of an inquiry in the case when a large number of researchers needs to be evaluated.

### **Elements of originality**

The PhD thesis contributes to the specialized literature on the efficiency and performance of the university scientific research through certain elements of originality in the realization of the research applied in the thesis. These consist in:

- analysis of the opinion of the personnel employed in research, concerning the university scientific research;
- realization of a profile of the university scientific research from the standpoint of the personnel employed in research;
- proposal of a system for university scientific research evaluation that takes also into account the opinion of the personnel employed in research.

The research also supplies the results of an inquiry about the opinion, conceptions and perceptions of a researchers sample from Romania, a category about which one can hardly find any information in literature.

**Future research directions** concern the development of the proposed evaluation system, laying the stress on the following aspects:

- Increase the sample volume by applying the questionnaire to researchers from the other universities of medicine from the country.

- Identify and consider additional dimensions of the performance of university scientific research in building up the evaluation system;
- Identify and consider also other indicators in describing the dimensions of the performance of university scientific research;
- Compare the performance scores obtained by applying the proposed evaluation system, with the results of other systems for the evaluation of the performance of university scientific research, developed in scientific literature.
- Adapt and apply the evaluation system to other scientific fields.
- System test and validation.

### **Research utility**

Determination of the profile of university scientific research using the standpoint of the academic personnel employed in research can be useful to improve the ways of communication and information between university and the academic staff with respect to the aspects related to the scientific research activity, with a positive impact on the performance and efficiency of university scientific research. At the same time, the elaboration of a system for measuring the efficiency and performance of the university scientific research, taking into account the standpoints of the personnel employed in research can contribute to a better substantiation of the research strategies of the universities.