

Proposition of a Tool for Measure and Evaluation of Quality in Scientific Research

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Abstract: *The importance to introduce quality in scientific research seen the various advantages that she can bring to it, as well as the absence of an evaluation tool of quality in research has led us to develop a questionnaire in this perspective. After apprehension of content of normative documents related directly to quality in research namely: experimental guide of quality in research, FD X50-550, FD X 50-551, GA X50-552 and NF X50-552, a synthetic list of main recommendations was establishes. It has served as a base for establishment of a questionnaire aiming at the diagnosis of quality in research. It composes of six parts treating generalities about the research laboratory, management of the laboratory, preparatory steps for scientific research action, realization of the research, valorization of results of the research and perspectives related to quality management. The questionnaire developed covers all research organizations: public and private laboratories, institutes, etc. This study will firstly concern the faculties of science and technology at the national level. The questionnaire is going to be administered to managers of laboratories via an electronic link.*

Keywords: Quality in research, evaluation, management best practices, questionnaire

1. Introduction

The various modalities of current research (submission to research projects, international collaboration, and collaboration with industrialists) raised the bar of requirements of partners with the aim of realizing a quality research which the results create an exploitable added value. The will to be in accordance with these requirements, more and more increasing, can be facilitated by implementation of a quality management system in research which can bring several advantages on the scientific, economic, human, social and environmental plans, as well as for research organizations and his researchers. Therefore, quality which was previously related to industrial world, the importance of its introduction in research was debated towards half of the 90s. From there on, guides and documentation booklet treating recommendations bound to quality in research were establishes.

Nowadays, the question that arises is bound to the level of application of these recommendations and best practices in scientific research. The suggestion of a questionnaire of measure and evaluation of quality in research was motivated by the absence of an evaluation tool in this domain.

Also, the article 79 of the law 01-00 plans the creation of a " national authority of evaluation " to proceed to evaluation planned by the article 77 of the same law and which concerns internal and external profitability of higher education and touches educational, administrative and research aspects. A national authority of evaluation has been created within the higher council of teaching. On the other hand, the analysis of the article 13 of Dahir N 1-05-152 of 11 moharrem on 1427 (in February 10th, 2006) treating reorganization of higher council of teaching, such as it was repealed and modified by Dahir N 1-07-191 of 19 kaada on 1428 (in November 30th, 2007) leads to conclude that evaluation of scientific research is not among the missions of this authority. The governmental authority, while waiting for

the implementation of a structure of evaluation, decided to set up national committees of evaluation to be able to estimate the various development programs of research. This analysis affirms the utility of elaboration of the evaluation tool treated in this article.

2. Method

By realizing a bibliographical study on the normative documents linked to quality management in research, it was found that there are standards which handle directly the subject and others which concern important elements bound implicitly to the research. Below a not exhaustive list of normative documents which can be very useful in the implementation of a quality approach in research:

- *Guide expérimental pour la qualité en recherche*
- FD X50-550 : *démarche qualité en recherche - Principes généraux et recommandations*
- FD X50-551 : *qualité en recherche - Recommandations pour l'organisation et la réalisation d'une activité de recherche en mode projet notamment dans le cadre d'un réseau*
- GA X50-552 : *Systèmes de management de la qualité - Guide d'application de l'ISO 9001 dans des organismes de recherche*
- NF X50-553 : *Management des activités de recherche*
- ISO 9001 : *Quality management systems - Requirements*
- ISO 17025 : *General requirements for the competence of testing and calibration laboratories*
- ISO 10012 : *Measurement management systems - Requirements for measurement processes and measuring equipment*
- ISO 10006 : *Quality management systems - Guidelines for quality management in projects*
- FD X50-117 : *Management de projet - Gestion du risque - Management des risques d'un projet*
- FD X50-252 : *Management du risque - Lignes directrices pour l'estimation des risques*
- ISO 31000 : *Risk management - Principles and guidelines*

- ISO/IEC 31010 : Risk management - Risk assessment techniques
- CEN/TS 16555-1 : Innovation Management - Part 1 : Innovation Management System
- FD X50-146 : Innovation management - Intellectual Property management
- FD X50-273 : *Management de l'innovation - Intégration du développement durable dans le management de l'innovation*
- FD X50-274 : *Management de l'innovation - Management de la créativité*
- FD X50-190 : *Outils de management - Capitalisation d'expérience*
- ISO/IEC 27001 : Information technology - Security techniques - Information security management systems - Requirements
- ISO/IEC 27002 : Information technology - Security techniques - Code of practice for information security controls
- General guidelines for the operation of research and technology organizations
- Quality assurance for research and development and non-routine analysis

Seen the significant number of these documents, we decided to focus on analysis of the various normative documents linked directly to quality management in research namely the experimental guide of quality in research, FD X50-550, FD X 50-551, GA X50-552 and NF X50-552.

The best practices of quality management extracted by means of analysis of these documents has served as a base to establish a questionnaire which aims at the diagnosis of inventory of fixtures of quality in research in Morocco.

These recommendations were transformed in form of questions while vulgarizing technical terms bound to quality management.

3. Result

3.1. Segmentation of the questionnaire

This work allowed to propose a first questionnaire of evaluation of quality in research. The questionnaire consists of six essential parts:

3.1.1 Generalities about the research laboratory

The first part of the questionnaire is dedicated to collect information about the identity of the laboratory via indication of the establishment of origin, department as well as number of research teams.

The objective also is to quantify the number of realizations of the laboratory in terms of theses, communications, articles, etc. and the number of projects concluded with industrialists, public institutions and international establishments.

3.1.2 Laboratory management

The segment « laboratory management » covers information related to:

- The structure of the laboratory: to know if research teams are constituted on the basis of homogeneity of affinities of research.

- The organization: treating the existence or not of an internal rules and a formalized management system.
- The management: broaching the definition of the vision and strategy of the laboratory, the declension of this strategy in objectives and the determination of indicators and action plans and, finally, evaluating the effectiveness of actions taken.
- The availability of the human, material and financial resources.

3.1.3 Preparatory steps for scientific research action

This part of the questionnaire approaches the various practices bound to the mounting of research project such as:

- The study of relevance, opportunity and feasibility of research: by lifting the study of adequacy of research with national politics and with domains of research of the laboratory, the study of innovative character of the research, formulation of objectives and problematic, and, last, determination of the scientific, technical, technological, socioeconomic and legal interests of the research.
- The piloting of realization of an action of research namely definition of the modalities of piloting of the action of research, determination of objectives and indicators linked to the results, risks, costs and deadlines as well as elaboration of dashboards.
- The mastership of management of risk of the action of research (identification, evaluation and prioritization of the risks and determination of the appropriate measures allowing to reduce and forward the identified risks).
- The organization and the planning of research: the questions related to this element aim at treating the formalization of actions to be undertaken in the time while definition of responsibilities, methods which are going to be used, distribution of financial means as well as determination of modalities of internal and external communication.

3.1.4 Realization of scientific research

The objective of this part is to verify if the action plan establishes in the segment «preparatory steps for scientific research action» is respected well and all data are registered. The purpose is to know also if in case of gap, detected by measure of indicators among others, an action plan is planned and whose efficiency is estimated. The validation and evaluation of results of research are important steps to complete a research project, a reason why, questions related to these two elements were treated.

3.1.5 Valorization of results of research

The valorization of results is the last stage of the process of research. In this part, questions treating modalities of protection, diffusion and exploitation of results were lifted.

3.1.6 Perspectives related to quality management

The last part of the questionnaire aims at collecting information linked to the quality management and the perspectives which are bound to it at the level of the research laboratory.

It is important to know the level of knowledge of normative documents related to the quality management by managers, reason why a question was put to test this knowledge. This

part also dealt with other issues linked to intend for implementation of a system of quality management as well as the evaluation of the importance of its implementation and the obstacles which are related to it.

3.2. Types of questions

The majority of questions treated on this study turn around:

- multiple choices questions;
- questions with scale of attitude (using the principle of Likert scale);
- questions allowing to affirm or to counter an information.

3.3. Administration of the questionnaire

After validation of the questionnaire, it will be administered to managers of laboratories of faculties of science and techniques on the national scale via an electronic link using Google form. The choice of this type of establishment for initiation of this evaluation was motivated by the fact of will to handle a homogeneous sample allowing to have the most reliable possible answers.

4. Discussion

The sequence of questions could be treated using two approaches:

- The first one consists in approaching the questions by following the plan adopted by the standard of quality management ISO 9001 namely: quality management system, management responsibility, resource management, product realization and lastly measurement, analysis and improvement.
- The second follows the stages of realization of a research project. Given that the questionnaire is going to be intended for laboratories managers who are not familiarized with jargon of quality management, we decided to choose the most understandable possible approach. Therefore, it is the second approach which is adopted and which consists in handling the questions by following the sequence of realization of actions of the process of research (fig.1).

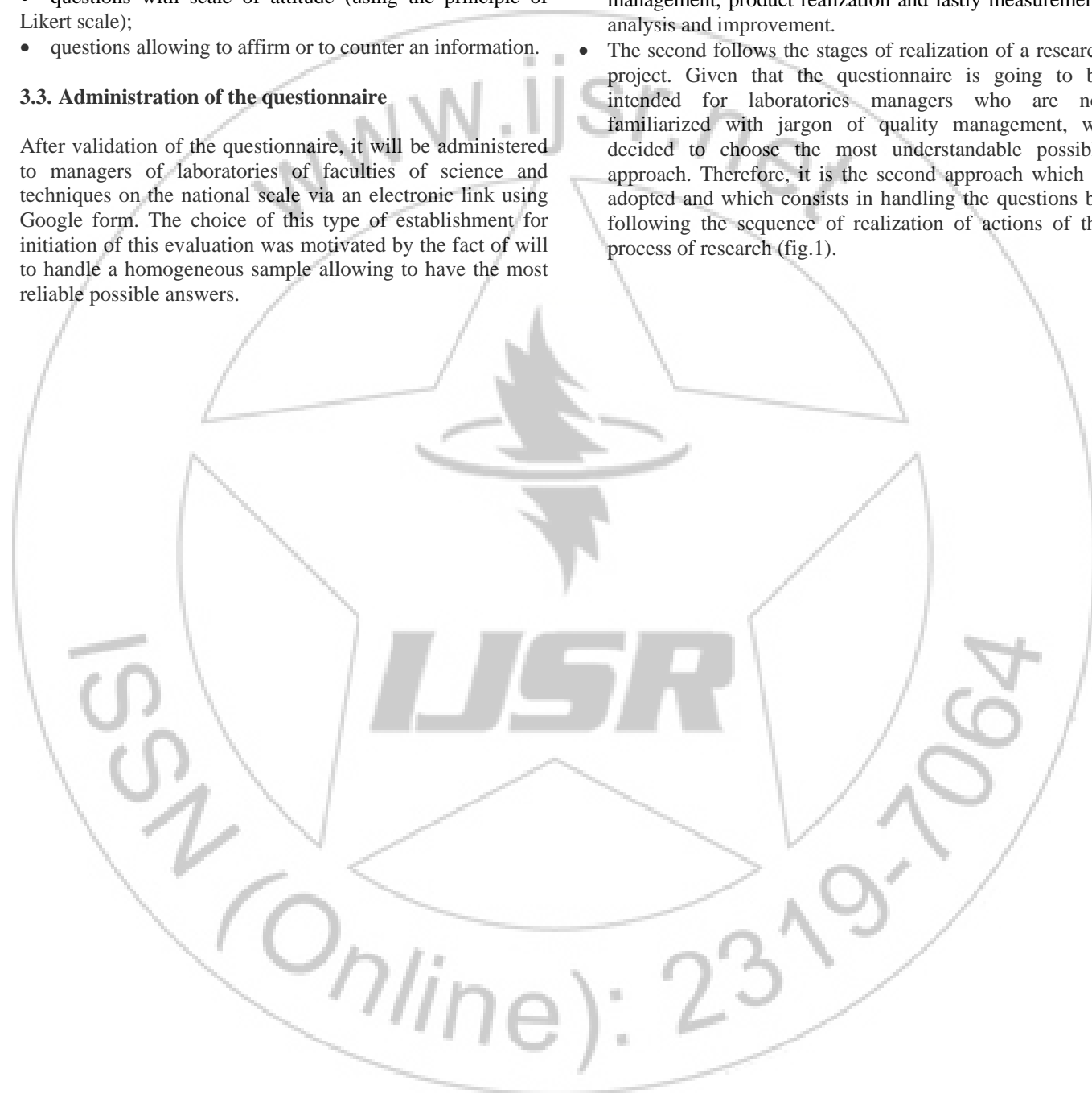


Figure 1: Macroprocess research

A research process begins with a lack of knowledge that triggers a scientific intelligence and expertise of available knowledge.

If this first stage filled the lack of knowledge, the process is enclosed; the made research can be considered as an autotraining.

Should the opposite occur, the process of research continues by definition of initial objective and problematic of research, a study of the novelty and the originality of the objectives as well as a study of risk and feasibility. Afterward, a stage of planning of works to be realized is necessary before the beginning of the research itself. Any result stemming from the made research must be validated and evaluated. If the results of this phase are satisfactory, the process of research is going to be enclosed by valorization and exploitation of products of research. Otherwise, a review of the preparatory steps for scientific research action and/or the planning of works to be realized must be made to fill in the lack of knowledge in the specified domain.

5. Conclusion

The questionnaire of measure and evaluation of quality in scientific research will allow, for the first time Morocco, to estimate the best practices of management in this sector considered as the engine of socioeconomic development of countries. The questionnaire developed covers all research organizations: public and private laboratories, institutes, etc. and it will firstly administer to the faculties of science and technology at the national level. Therefore, the diagnosis which is going to be realized, will lead to propose an action plan adapted to the real situation of this sector. This perspective aims at the continuous improvement of the domain of scientific research to enhance its quality and reduce the gap existing between Morocco and developed countries.

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