

APPROACHES AND METHODS FOR EVALUATION OF RESEARCH ORGANIZATIONS

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Abstract:

This paper presents approaches and methods for evaluation of research organizations. This is a newly set-up concept to be applied in Vietnam because the methods developed in other countries do not match with science and technology (S&T) requirements and conditions in Vietnam which is being on a transfer process. The evaluation of research organizations is useful tools to support S&T management works since the outcomes of evaluation works would be indicators for management and support agencies to know results of activities of research organizations. At the same time, the outcomes of evaluation works would let research organizations themselves know the ways to improve efficiency of their own activities.

Keywords: *Evaluation; Research organization; Method; Indicator; Evaluation procedure; Result of activities.*

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1. Why is the evaluation of research organizations needed?

Public research organizations play important roles for development of every nation. They have duties to define and resolve socio-economic problems and to establish development orientations. The Government provides science and technology organizations (S&T organizations) with budgets for realization of research activities to produce new scientific knowledge, to develop new technologies and to transfer new knowledge and technologies to end users for successful commercialization. There exist a lot of questions in this field of evaluation. How can the funding agencies (ministry authorities and support institutions) know the efficiency of use of their provided funds and supports? Do research organizations conduct new and advanced research works? Do they produce new technologies and transfer them successfully to users to create new products and services or to improve existing ones? Do research organizations work effectively? Which research organizations need a greater allocation of support funds on basis of their good performance of R&D works? Which research organizations need to revise and improve strategies and activities to get a better efficiency rate?

Then the evaluation works of research organizations are required to get the answers to these questions.

Definition of “evaluation”: Evaluation is a systematic analysis of quality, value and importance of a strategy, organization, project or any other initiative. Evaluation works make analysis to see if the objectives were set-up reasonably, if the initiatives were well planned and effectively implemented and if the investment sources were used in the best way. In addition to analysis, the evaluation needs to support decision making process through identification of necessary changes in future and recommendation of required improvements (see www.wikipedia.org and Sarah del Tufo).

The evaluation of research organizations is the systematic analysis of effectiveness, strength and weakness of actual activities as well as socio-economic benefits they can provide. It also helps to identify the research organizations which provide highest effectiveness. The evaluation permits to rank research organizations, to define chances for improvement and to maximize benefits that S&T could bring to the society.

On basis of conceptual studies and practical observations, the research project team notes that, for better values of socio-economic contribution for Vietnam, research organizations need to complete 5 important tasks: i) Providing high quality of scientific research for new and valuable knowledge; ii) Developing of new technologies, products, methods and services; iii) Transferring new S&T to end users and commercializing successfully new S&T findings; iv) Providing S&T services and consultations; v) Supporting S&T development through education and training activities.

Research organizations are said to achieve high efficiency of activities if they complete all these tasks. It means also they produce valuable S&T results, enhance economic productivity and competitiveness, increase incomes and benefits from new products and services.

For this reason, all the leading and immerging nations are very active in evaluation of their research organizations.

Example: Evaluation of research institutes of the Chinese Academy of Sciences (CAS).

CAS, with more than 100 research institutes and 60,000 researchers in all the fields of natural sciences, is the leading independent national research institution of China.

Established in 1949, CAS makes great progresses in scientific research. The number of research institutes and researchers of CAS increases

considerably. In addition to quantitative extension, CAS actually concentrates efforts for qualitative development and productivity of research activities of member institutes. In majority of cases, member institutes make their best to keep pace with the world leading research institutes in advanced countries. To enhance international competing capacities and sustainability, it is important to analyze working efficiency and to identify strength and weakness of research institutes in China. Therefore, CAS proposes studies for evaluation of local research institutes and comparisons to leading research institutes of the world. CAS puts priorities to identify the differences between their research institutes and the world leading research institutes.

2. Actual status of evaluation of research organizations in Vietnam and objectives of development

Before promulgation of Law on S&T in 2013, Vietnam has no regulations for evaluation of research organizations. Every year, research organizations make annual reports of activities submit to management authority agencies without making any evaluations on basis of standard methods and indicators.

The new Law on S&T revised and promulgated on 18th June 2013, in its Article 16 and Article 17, require the necessary evaluation of S&T organizations including research organizations.

In fact, Law on S&T encoded 29/2013/QH13 stipulates:

Chapter 2. Evaluation and ranking of S&T organizations.

Article 16: Objectives, principles of evaluation and ranking of S&T organizations.

- 1. Evaluation of S&T organizations is the use of specific knowledge and skills to define the capacities and effectiveness of activities of S&T organizations.*
- 2. Evaluation of S&T organizations has the following objectives:*
 - a) Offering a basis for ranking of S&T organizations;*
 - b) Providing services for S&T development policy planning activities and S&T network establishment;*
 - c) Offering a background for: i) examination, selection and assignment of hosting duties for S&T tasks; ii) priority allocation of investments from State budgets; iii) offer of grants, financial supports and guarantees of loans from S&T funds.*

3. *Evaluation and ranking of S&T organizations are realized on basis of the following criteria:*
 - a) *Being equipped with adequate methods and indicators for evaluation;*
 - b) *Being based on principles of independence, equality, objectivity and legal conformity;*
 - c) *Being followed by public and transparent announcement of results of evaluation and ranking works.*

Article 17. Evaluation of S&T organizations for purpose of State management

1. *Government-funded S&T organizations have to be evaluated for purpose of State management.*
2. *Evaluation works of S&T organizations for purpose of State management are to be conducted by State S&T authorities or independent evaluation agencies.*
3. *Evaluation of S&T organizations is realized on basis of methods and indicators specifically fixed by the MOST for every form of S&T organizations.*

The implementation of requirements noted in the above legal articles is a kind of challenge. The evaluation of S&T organizations in general and research organizations in particular is a new approach in S&T management in Vietnam and up to now the adequate methods are not yet completed. Vietnam has no experience in this type of evaluation works because the necessary methodology is not yet introduced and there is a lack of experienced evaluation experts.

The effective implementation, however, of Article 16 and Article 17 of the Law would produce useful results to support management activities of research organizations because of the following reasons:

- (1) Ministries, local government administrations and authority agencies would get regularly information on effectiveness, produced results and created values of activities of research organizations. Evaluation outcomes would show well the effectiveness of activities of research organizations in comparison to established requirements and/or international standards. When the evaluation works are conducted regularly, it is possible to check/control the improvement of quality and effectiveness of activities of research organizations;
- (2) Research organizations can be rated and ranked according to their efficiency. The best organizations would get certain incentive supports for their efforts. The information produced from evaluation works can be

used for improvement of the structure of S&T systems through the restructuring or merging measures of low-effective research organizations;

- (3) Research organizations, on basis of evaluation outcomes, can note their strength, weakness and orientations for progress. Then they would have measures to enhance efficiency of their activities.

For this target, it is necessary to build up the methodology for evaluation indicators and necessary conditions suitable for evaluation activities in Vietnam. Also, S&T leaders and managers need to know the adequate time to introduce evaluation works, to select suitable evaluation methods and to use evaluation outcomes for better management practice.

3. Feasible methods for evaluation of research organizations

The analysis of evaluation results conducted by some nations and leading research organizations in the world shows that there is no methods which can be used as standards. Every country sets up and applies its own methods for evaluation of its research organizations. Some countries and research organizations prefer large-scaled evaluation works and some others do not want to make big investments of resources for this type of works. This situation is illustrated by the following examples which show well different ways to practice evaluation of research organizations.

Peer review method: Experts having deep understanding of the related scope visit the organizations from 1 to 3 days for evaluation. Before the visit, the research organizations need to prepare necessary data. The data related to S&T strategies, process of activities and management, and results of the research organizations under evaluation are topics of discussion between managers of the research organizations and the evaluation team members. Gathered information and conclusions are backgrounds for a report which would include presented and gathered information and evaluation comments/recommendations. The most advantage of this method is the time saving benefit and the maximal use of high expertise of evaluation team members. This method, however, requires a lot of experiences and expertise of the evaluation team members. More than that, the method does not produce quantitative evaluations then it cannot allow to rank research organizations.

There exist two ways for consideration of gathered information. First, different experts are to be invited for each evaluation round. Second, the same experts are invited for evaluation rounds. The choice of ways depends on the concept they practice. For example, Max-Planck Society prefers to set up evaluation consulting committees from permanent experts. The latter participate in regular evaluation rounds. The biggest advantage of this way

is the deep understanding of the related research organizations evaluation member have. They know well the recommendations already made from previous evaluation visits and they have chances to examine the implementation of recommended conclusions.

Evaluation audit method: Professional experts are invited for evaluation. This method uses high standard methodologies including questionnaires, data sets, analysis reports and form sheets to produce evaluation conclusions. The biggest advantage of this method is to produce highly credible results without heavy consumption of efforts and resources. It can compare the efficiency rate between different research organizations. This method would make more effects if certain members of the research organizations under evaluation can participate in evaluation process.

Self-evaluation method: It is the case when research organizations conducts themselves the effectiveness of their own activities. These research organizations would get a set of prepared form sheets for self-evaluation. They need provide also necessary information as evidence for their conclusions. The biggest advantage of this method is the minimal mobilization of efforts and resources. The produced results would become really useful when the research organizations provide credible information and conduct properly the evaluation works.

Therefore, every research organization needs to balance well their targets before selecting the most suitable method of evaluation. The low effort consuming methods, such as the self-evaluation method, have big advantages in minimal additional works and directly access efficiency of actual activities. From another side, however, this method produce less information. The methods consuming more efforts can produce more credible information on strength and weakness, requirements and potential resources for improvement. Naturally, these methods require considerable investments of time and resources.

In many countries, the evaluation of research organizations started from the first practice and the used methods get more complex, developed and improved afterwards.

Example: Evaluation of Government-funded research organizations in South Korea.

In South Korea, the Prime Minister Office started the first evaluation of Government-funded research organizations (GRIs) in 1991. On basis of these evaluations, some GRIs have to dissolve, re-structure or merge with other research organizations. From 1999 to 2005, 4 Research Councils were established. Every Research Council conducts the evaluation of GRIs in their fields of expertise and research.

Since 2006, South Korea introduces a system for evaluation of GRIs on basis of effectiveness of activities. The allocation of budgets for GRIs can be change subject to outcomes of these evaluation rounds.

For more effective evaluation, it is necessary to set up properly evaluation teams. Some countries establish professional evaluation organizations, such as the cases of National Center for S&T Evaluation (NCSTE) in China or Agence d'Evaluation de Recherche et Etudes Superieurs (AERES) in France.

4. Which methodology and practice are suitable for evaluation of research organizations in Vietnam?

The research project team conducted analysis of methodologies used in some OECD countries. The team cooperated with international experts to get their ways of evaluation. In Vietnam, Vietnam Center for Science and Technology Evaluation cooperated with Germany experts to conduct pilot project of evaluation for the first 4 research organizations in 2013.

The lesson learnt from these pilot evaluation projects shows that Vietnam cannot copy any methodology of evaluation from other countries but has to produce its own methodology. The latter has to meet the following criteria:

- (1) The methodology of evaluation of research organizations has to be realistic, simple and easily applicable. Many data used for evaluation in developed nations are not found suitable in Vietnam. Researchers, managers in research organizations, evaluation experts and other stakeholders need time to get closer familiarized to this new tool for S&T management and to learn to apply it in effective manner;
- (2) The methodology of evaluation of research organizations needs to consider the socio-economic context, administrative and political frameworks in Vietnam. The management practice of research institutes and the S&T structure in Vietnam are different from the ones of Occidental countries who develop advanced methodologies for evaluation. In order to meet the real context in Vietnam, these methods need to be modified and adjusted.

For purpose to meet the above requirements, we are here to propose a method of the first generation for evaluation of research organizations which is, in fact, the Evaluation audit method. It is the most effective method to get fast evaluation results in practice and to build up necessary capacities. Other methods of evaluation which are more detailed and complex will be introduced later.

The method described in detail below is a framework of a global methodology which is applicable for various forms of research organizations. The definition of the framework of a global methodology is highly necessary since it is difficult to evaluate exactly multi-form research organizations in the same way. The following examples indicate clearly why we need to identify differences between the various forms of research organizations.

- (1) Research organizations which are focused on R&D activities can be evaluated on basis of R&D products. But another concept on basis of actual S&T activities would be applied for other forms of research organizations;
- (2) Research organizations which are focused on fundamental researches should be evaluated on basis of successes of their original research activities. Research organizations which are focused on applied researches (targeting to create new technologies) should be evaluated on basis of use and commercialization of new technologies they develop;
- (3) Different fields of sciences should have different ways to conduct research activities and to measure the rate of success. For example, the research activities of natural sciences are conducted generally in laboratories equipped with sophisticated tools to create products to be made public internationally. Research activities for social sciences and humanities need to have other methods for evaluation and, as rule, they rarely develop new technologies and products. But the services they can provide, such as proposals, recommendations and consulting comments for policy makers, can be found highly valued and more appreciated than technologies and products.

For these reasons, we need to develop a framework flexibly applicable for various forms of S&T organizations. The next part will describe the prototype format proposed for evaluation of research organizations in Vietnam.

5. Methodology for evaluation of research organizations in Vietnam

The research project team conducted analysis of methodologies used in other countries. The team cooperated with Germany experts to build up a methodology of evaluation from basic ideas that an effective research organization needs to gather 9 successful components¹. If a research organization does well these 9 successful components, it would have good results of activities and produce valuable products on basis of well based

¹ Stefan Kuhlmann, Doris Holland. (1995) *Erfolgsfaktoren der wirtschaftsnahen Forschung*. Physica Publishers, Heidelberg, Germany, ISBN 978-3-7908-0845-2

strategies and strong resources. The level these 9 successful components are achieved can be measured on basis of actual indicators. The total results of all the indicators are summarized and measured according to a scale for evaluation of global activities of research organizations. This method permits to mark strength and weakness, and requirements of improvement. At the same time, it permits to produce measureable quantitative evaluation of activities and to compare them to other research organizations.

The 9 successful components are listed here, namely:

5.1. Development strategies

The objective is to evaluate if the research organization carries out correctly their research tasks, organizes a systematic implementation to mobilize all the existing capacities and applies all the resources in effective ways for success. For example, if a research organization implements activities for non-related orientations of researches it could not create new knowledge. Another case, a research organization not having plans to build up and develop capacities of scientific staffs would never get progress in effectiveness of activities and never develop competing capacities. For evaluation of this component, we need to have experts to analyze the research strategies of research organizations.

5.2. Effectiveness of activities and outputs of scientific research

The objective is to evaluate if the research organization creates valuable results of scientific research. International indicators to measure these results are scientific publications and the recognition from other researchers (measured by citations and reference notes). This successful component would be said achieved if the research organization can demonstrate scientific research capacities and values of their research results on basis of national and international publications and recognition from other researchers.

5.3. Effectiveness of activities and technological outputs

The objective is to evaluate if the research organization creates valuable and useful technologies for socio-economic benefits, transfers effectively these technologies to end users and commercializes them successfully. In the countries with developed S&T systems, the number of granted patents of the research organization is used to evaluate the research outputs. But this way cannot be applicable in Vietnam because the total number of granted patents in Vietnam is very low and, as practice, researchers usually do not file patents for their own inventions. Therefore, here we need to have

another way for evaluation. The most feasible alternative is to use the volume of annual turnovers the research organization can earn from selling or licensing technologies (because only the research organization creating many technologies which are new and highly valuable can find customers to pay for them).

5.4. Science and technology services

The objective is to evaluate if the research organization provides valuable services on basis of its own S&T capacities such as technical services of checking and measuring activities and proposals of solutions. A typical S&T service is the consulting service for Government agencies in policy making and implementing process. Here the simple indicators to measure S&T services are the quantity and the type of provided services (consulting services for policy makers and the ones for enterprises) and/or the annual turnover from such services.

5.5. Education and training activities

The objective is to evaluate if the research organization carries out quality training activities (post-graduate training in majority of cases) and/or provides training courses for stakeholders (leaders of enterprises or government agencies). The education and training activities of research organization can be measured on basis of the number of post-graduate and doctorship students or the annual number of trainees and offered training courses.

5.6. Human resources

The objective is to evaluate if the scientific staffs of the research organization have adequate capacities, qualified scientific knowledge and required skill to conduct up-to-date researches. A typical indicator to measure the qualification of scientific staffs is the number of granted certificates and grades (for example, the number of doctors and masters, the number of staffs graduated from internationally prestigious universities). Another method applied for evaluation of the structure of human resources is the percentage of scientific titles (professors, associate professors, doctors, masters and their ages).

5.7. Scientific equipment and research infrastructure

The objective is to evaluate if the research organization has the necessary scientific equipment and infrastructure to conduct the most advanced research works. The research infrastructure includes laboratories, research machines and equipment, information sources and scientific documents.

This component would be evaluated better by scientists in the same sector (they know better that if the existing infrastructure is suitable to conduct targeted research projects). The measurable indicators useful for evaluation of this success component are the average age of equipment, annual mortgage values, annual costs of maintenance and upgrading of equipment and the possible access to expensive equipment.

5.8. *Finances*

The objective is to evaluate if the research organization has the financial resources enough to carry out assigned tasks and if the financial structure is suitable for them (for example, operational budgets, revenues from research projects, transferred technologies and offered services). For evaluation of this successful component, we had developed an analysis tool based on Microsoft Office Excel which collects and treats all the financial resource data of the research organization to give measurable answers to the above questions.

5.9. *Cooperation and internationalization*

The objective is to evaluate if the research organization develops fully the cooperation with local and international researchers, gets involved in research projects and carries out research exchanges with local and international communities. Another question deals with the effective cooperation with users of research results (for example, enterprises) to secure the usefulness and the successful transfer of research results. The typical method for evaluation of cooperation activities of the research organization includes the number and the level of conducted cooperation activities (official agreements, high importance of cooperation projects) including the ones made with enterprises. The typical method for evaluation of international partnership is the number and the scale of official cooperation agreements including the total working time of the exchanged staffs, the membership status in international associations and scientific networks, annual revenues from international projects.

Basically, the above noted 9 successful components can be used to evaluate all the forms of research organizations. The actual application, however, needs to be adjusted adequately to meet the nature of research scope and activities of research organizations. For example, for evaluation of natural science research organizations the outputs of research results have the prevailing values. For applied research organizations, the number of scientific publications is not so important as the outputs of highly classified technologies, successful technology transfers and the revenues from their commercialization are.

6. How is the evaluation work implemented for research organizations?

The methodology for evaluation of a research organization we had developed is based on the collection and analysis of required data in the following 4 steps.

Step 1: Collection of data and information

The evaluation work has to be based on real facts. Therefore, the first step is to collect required and credible data and information. For this purpose, it is necessary to design the survey sheets and send them to the research organizations under evaluation. These sheets include the investigation of general information, detail data and information related to the 9 components as noted above.

The research organizations under evaluation gather data and information to provide answers to the requests noted in survey sheets. Experts will make analysis of provided data and information and target visit sites for the next steps.

Step 2: Visits and discussions between evaluation experts and staffs of research organizations under evaluation.

The external evaluation team visits and works with the key management staffs and researchers of research organizations. The topics of discussion are related to the 9 successful components which would be followed by site visits to research infrastructure.

Step 3: Draft of a brief report of outcomes of evaluation by external evaluation experts.

On basis of data from survey sheets, on-site survey visits and other additional studies, evaluation experts prepare a draft of the evaluation report.

For evaluation of research organizations on basis of the 9 successful components we used many indicators every of which is evaluated in 2 ways.

(1) Quantitative evaluation

The indicators are used to measure the achievement level of the components. The scores show well the level the research organizations under evaluation complete the assigned tasks and meet the international standards applied to research organizations. The research organizations are evaluated according to the score scale from 1 (bad results of activities, failures in implementation of functions and tasks) to 5 (excellent results of activities, even in comparison to the world's best practice of research organizations).

The total won score of the 9 successful components is used for evaluation. In order to indicate the importance of every component we use the weight factors. The different systems of weight factors are applied to different forms of research organizations. For example, for natural science research organizations the number of scientific publications is found very important then it has a higher weight factor. For applied research organizations, the number of technologies (inventions) turns out to be more important and, then, gains a higher weight factor.

The following figure illustrates the weighted scores gained by research organizations on basis of individually won scores of the 9 successful components.

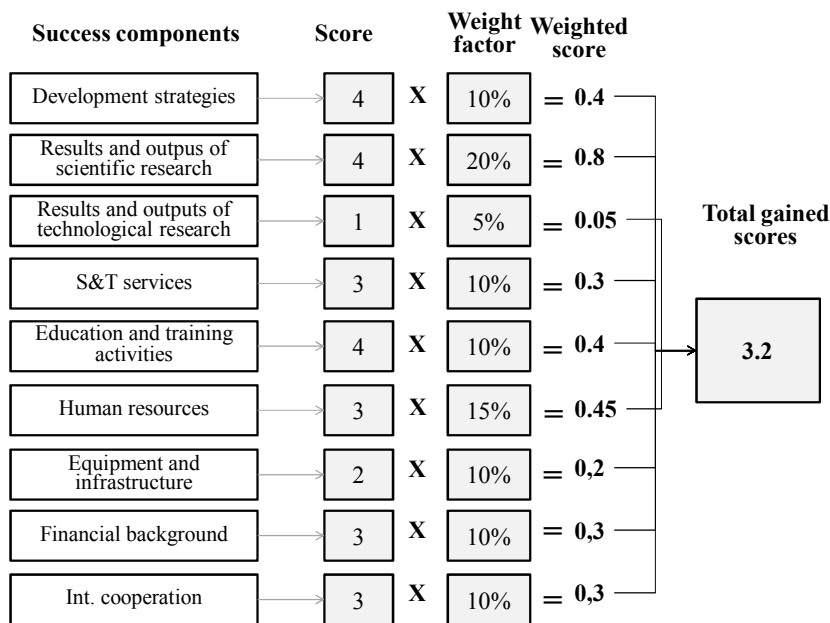


Figure 1. Illustrative example of the score calculation on basis of the 9 successful components

Being supported by the above scores, the research organizations know well how their activities are good and how they should do improvements in relation to their functions and tasks in Vietnam as well as their positions in comparison to international standards and other research organizations. If the same evaluation will be made the next time, they would know also the progress or failures they make on basis of comparison of the total gained scores for the two evaluation rounds.

(2) Qualitative evaluation

For every aspect of evaluation, experts would provide comments to explain strength and weakness, and development requirements. These explications are very important for the leading bodies of research organizations and hint the ways to enhance activity effectiveness.

Experts present the brief results of evaluation in their draft for final report.

Step 4: Discussion and final report

The external evaluation team presents their findings to the leading bodies of the research organizations under evaluation. The two sides discuss and come to the conclusion of evaluation results. Then the external evaluation team prepares and completes the final evaluation report.

In order to validate the final report, the external evaluation team needs to have an exhaustive discussion with the research organizations under evaluation. The latter can make some feedbacks and give their points of view. If the research organizations under evaluation have some disagreements, the controversies would be discussed again and finally the two sides come to final agreement. Then the final report would be completed and then submitted to related agencies.

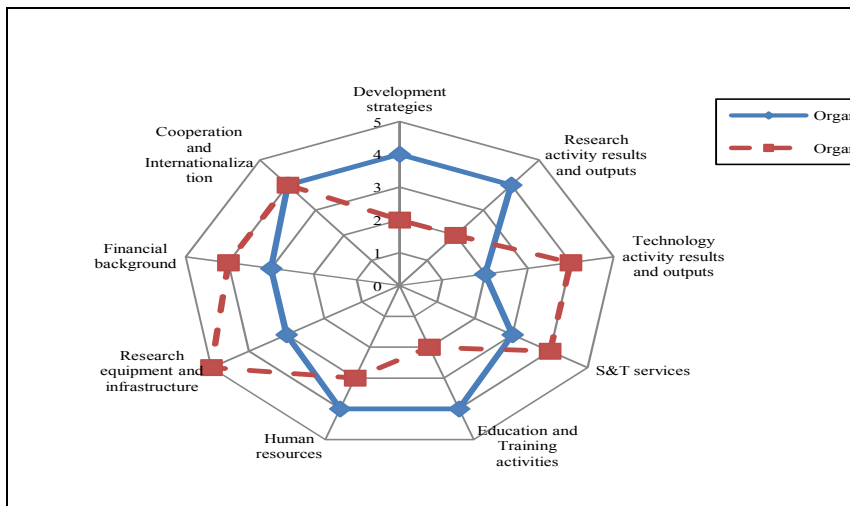


Figure 2. Illustrative example for comparison of evaluation results of two research organizations

In this example, the evaluation shows well that Research organization 1 has good research results and human resources. It carries out excellent research activities and is successful in training activities. This organization, however, is not successful in creation and transfer of technologies. It needs

to improve financial resources and to develop research infrastructure. Research organization 2 is focused on technological outputs. It has very good financial resources and research infrastructure. It, however, has no clearly set-up S&T strategies and has limited results in scientific research, training activities and services.

7. How to conduct evaluation works of research organizations in Vietnam?

For the purpose of enhancing effectiveness of activities of S&T organizations and to create more valuable research results for economic development and innovations, ministries and local government need to have more right information about activities, strength and weakness, and existing problems of research organizations under their management. On this basis, the authority agencies could build up suitable policies for better assistance. This information can be supplied correctly and effectively through monitoring and evaluation systems of scientific research organizations. Therefore, Vietnam needs to develop a regular system of evaluation of scientific research organizations.

7.1. Methods and approaches

Since we do not have high-qualified experts capable to apply modern and sophisticated methods which are developed in advanced countries, and local S&T organizations and their partners do not practice yet evaluation works, we need to introduce evaluation works in a simple and practical manner in conformity to existing capabilities. Then, more complex methods will be put in practice later.

We also cannot to apply evaluation for all the existing S&T organizations since this would be a huge volume of works requiring great resources. At the initial stage, we should carry out evaluation for big sized and important research organizations. On basis of gained experiences, we would adjust and develop a system of evaluation suitable for practical use in Vietnam.

7.2. Consistent development of necessary environment for application

Together with development of evaluation methodologies and effective application we need to have plans to develop capacities, qualification, skill, legal background, guiding instructions, toolkits and form sheets of evaluation, shortly a proper environment for application of evaluation works.

Leading bodies and managers of research organizations need to understand objectives and to keep cooperative standing with evaluation experts. The

evaluation can be productive only if all the concerned parties join for cooperation and provide necessary and credible information for evaluation and then keep a positive vision to evaluation conclusions./.

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