

The Role of Scientific Research in Modern Society

Maia GRÎU*

Abstract

Research, development and innovation is for any country the engine of its economic and social development. Common concern of all countries for science and scientific research appears as a recognition of their role in ensuring the welfare of human civilization. The level of society development is determined mainly by performance of its education and research systems, educational level of its citizens, the quality of research activity products and equitable access of all potential users to the services and products of these systems.

Keywords: scientific research, fundamental research, applied research, development research, technological progress, innovation

1. Introduction

Building a knowledge-based economy has become a rational goal for any state in the world. This is the road to competitiveness, growth and economic prosperity.

Economic science demonstrates that sustainable growth cannot be achieved by investing and maintaining stable macroeconomic conditions, unless they are backed by technical progress, that amplifies the value of capital and labor. Therefore the shift from exploiting resources to exploiting knowledge represents the touchstone of the shift from the cost-based competitiveness to the competitiveness based on the final value.

Scientific research is a systematic and creative activity aimed at increasing the volume of knowledge, including knowledge about man, culture and implementation of this knowledge in new applications. The concept of scientific research is also known today under the name of Research and Development.

Scientific research produces science, which is incorporated to a great extent into the technological products. Moreover, scientific research multiplies itself (since as opposed to the material values, the scientific ones are not consumed or lost), it promotes education and educates, leading to social superiority.

Scientific knowledge has the property to accumulate and multiply itself over time. When being used, knowledge is consolidated, improved and complemented. When being accumulated, knowledge becomes a free source of human creative power and it is not alienated when transmitted from person to person, but usually remains in the possession of those who have created the scientific knowledge.

Scientific research needs researchers, i.e. professionals in various scientific fields, as well as equipment, financial resources and infrastructure. There are two distinctive ways by which scientific information can be created and applied, namely:

* Maia Grîu, Phd ASEM, University lecturer USEM. E-mail: maiagriu@gmail.com

- ensuring availability of an organizational framework, of the means of collection, storage, processing and transmission of scientific information;
- creation of the new scientific knowledge through research activity conducted in laboratories, research institutes and academies.

Research products can include inventions, innovations, new materials, computing programs (software), equipment, technologies, modern systems of management and staff training etc.

Like other issues, current scientific research should be approached in the context of globalization phenomenon. The research field also faces global real-world challenges:

- science and research should take into account: the globalization of economic life, the deepening of international division of labor, the emphasizing of international relations, the limited character of resources and their uneven distribution across the globe, environmental protection and ensuring of sustainable development of mankind;
- the need for scientific research is an acute problem and requires great effort that sometimes cannot be supported by a single state;
- the issues of sustainable development have to be solved from international perspective.

Not bringing profit by itself, scientific research must be funded primarily by the state. This is a worldwide practice. The social motivation to sustain scientific research has always been production of scientific knowledge that contributed and further contributes to economic and social development. The scientific innovation creates capabilities to manage social, economic, financial, military crises, etc. Today many developed countries motivate scientific research from the perspective of ensuring military superiority.

Qualitative scientific research is a vector of progress and development. The need for national medium and long term strategy in the field of scientific research, as well as rigorous assessment of the real state of scientific research and its human potential, are obvious.

Universities have an important role in contributing to knowledge production, its transmission and use. Within universities scientific research represents an inseparable part of an effective education system and is essential for the development of higher education itself.

The Bologna Process stressed the need to stimulate performance, competitiveness and excellence, to internationalize and globalize the research activity. It has acknowledged the need to build the European Area of Higher Education and Research, as the foundation of a competitive knowledge-based society.

2. Results and discussion

The scientific research activity is the highest mode of human resource development, both through continuous training / information that it requires, and through the results obtained. It is an indispensable activity for solving global problems of the society.

Econometric analysis confirms the importance of research and development

activity for economic growth and ensuring competitiveness, as well as the importance of macroeconomic environment, market opening and financial markets development.

Scientific research is based on the creative potential of people who are involved in innovative activities. Innovation implies specific skills (such as sensing market opportunities related to technological developments, identifying technical solutions, evaluating the cost-benefits ratio and the inherent risks, identifying necessary resources, etc.), skills that have to be acquired at the level of employees and managers, or incorporated in organizing the entity.

The innovation analyses evolved from linear vision of innovative process to systemic vision that currently dominates the economic thinking. Even though both visions consider research and development either as an initiator or as a decisive factor of innovative process, the latest approaches tend to give greater importance to innovation factors outside of the research framework itself and even to the external factors of technological process, as well as to some aspects related to organizational and managerial dynamics.

The innovation process involves several elements, namely:

1. research system (in the center of knowledge production);
2. innovative companies – the engines (leaders) of innovation (enterprises that transform knowledge into products for the market);
3. innovation infrastructure;
4. available capital and financing channels;
5. labor resources and educational services (human capital).

In reality these elements overlap and in result a research unit may function also as an innovation leader or, alternatively, companies may have their own research units etc.

The success of the knowledge-based economy depends on how interaction is made with the business environment and on the resources available for generating new products and processes. The mechanisms by which this is achieved represent the innovation process itself.

The research areas are mostly oriented to technologies, then follow the natural sciences, exact and humanitarian sciences.

Increasing the competence and efficiency of the research - development activity can be achieved through attaining of some objectives such as:

- achieving results that are of interest to beneficiaries in economy / society;
- correlating research topics funded from the budget with the sector medium and long-term strategy;
- promoting partnership between researchers and beneficiaries / users of the research results;
- supporting the implementation of the results obtained by the beneficiaries / users;
- developing human resources through creating and training for the purpose of and by means of research and development, as to enable them to use the results of the research and development activity;
- developing research infrastructure - developing and creating centers of excellence in priority areas;
- developing innovation infrastructure (innovation and business offices, technology transfer centers, technological information offices);

- establishing risk funds for implementation of research results;
- instituting a flexible management system for budget funds on research and development programs.

Generating scientific knowledge occurs within research centers and networks, which should be furnished with last generation equipment, devices and software. The research units may develop their resources through grant programs for research. In addition to professional satisfaction and activity in modern conditions, researchers should be also attracted and motivated by an adequate salary.

Research and development units will have to increase their ability to disseminate knowledge, results, experiences, by developing marketing services, industry connection offices etc., and to intensify public promotion (through catalogs of products, newsletters / informative and promotional publications, conferences, demonstrations of products / technologies, audio-video presentations, launching programs / projects etc.).

Research and development units will have to increase their ability to use scientific and technological knowledge through:

- increasing the absorption capacity of innovation in the economic environment as a result of training and refresher training courses for beneficiaries / users of the results of research and development;
- supporting the mobility of researchers, specialists and students from the research institutes and universities to the companies;
- improved access of companies to information facilities and scientific support services.

Increasing the potential of research, development and innovation can be achieved at the company level through elaborating of research, development and innovation projects between industrial partners and research and development units. Another way could be co-financing of collaborative projects between businesses and research and development units. Introduction of quality management system requires companies to improve their work, i.e. to perform research, development and innovation.

But research is not exclusively economy-oriented, it should also be carried out and encouraged in the field of culture and national heritage.

The process of scientific knowledge points out that the act of creation and scientific research represents a homogeneous, specific activity of certain people endowed with native skills of scientific creativity and scientifically trained.

Research can be classified into fundamental and applied research, or in terms of expenses of the research and development projects in: fundamental, applied and development research.

1. Fundamental scientific research

Fundamental scientific research is a theoretical or experimental activity aimed to gain new knowledge on fundamental aspects of observable phenomena and facts, without seeking special or specific application.

This type of research is deciphering the mysteries of nature, thought and society, creating new openings for scientific knowledge, technological, economic and social progress.

A special place is held by experimental research carried out in research

laboratories with devices, specific equipment, different materials, energy in several forms (most often electrical, as well as mechanical and magnetic). New materials are discovered (eg composites, synthetic organic substances, pharmaceuticals, electronic equipment), as well as new applications for materials and, new technologies (in the field of nanotechnologies, biotechnologies, unconventional and alternative energy, medical science, environmental protection etc.).

In economic sphere the fundamental research is focused on major theoretical issues, such as economic growth and modeling, business process analysis and forecasting, financial, fiscal and monetary issues, politics – economics - society relationship, globalization etc.

2. Applied scientific research

Applied scientific research is an original activity of new knowledge accumulation, primarily aimed at a specific practical objective.

It uses results of other forms of research (fundamental and development research), empirical knowledge gained from practical experience in establishing new techniques and technologies (new products, new technological options), new forms of management, marketing etc.

Applied research is usually done in three stages: in laboratory, in pilot plant and then in semi-industrial installations. In laboratory the work is performed on small-size installations, with small quantities of material. In pilot plant the equipment sizes and consequently, the amount of materials and energy, increase as to be closer to industrial conditions in large production capacities. The three stages are not mandatory to go through. Sometimes it works only on semi-industrial installations. The results of such research are used for designing industrial plant.

3. Research and development

Research and development is a systematic activity to launch the manufacture of new products, new processes, systems and services or to substantially improve the existing ones.

It uses the knowledge already gained in the earlier stages of research and/or experience. This knowledge is used to achieve principle solutions for designing, implementation and prototype testing of new equipment, equipment for new technological processes etc.

Two main stages can be here distinguished:

- designing of economic activity, of material, energy, artistic or social production etc.;
- implementation of the projects.

During the designing stage is applied specific knowledge, with mathematical support, computer programs, including computer graphics.

In the implementation phase of the projects there may be accomplished a device, a product, an equipment etc. as prototype and sometimes as individual series.

The three types of research may be interdependent. For example, from the applied research one can derive new general principles, therefore the fundamental research can be approached. From the fundamental research new possibilities for application may arise.

Fundamental and applied research mutually support themselves and supply products for technological development and, consequently, for the development of research.

3. Conclusion

Research determines needs, indicates solutions and provides the means for implementing the solutions. The distinction between its three types (forms) remains useful for managing scientific research, so that the results of research reach the stage of progress and the funding policy is properly subordinated.

Research and development activity is concentrated in public sector (about 80%), the remaining 20% of the total representing private research. One of the possible explanations for this very low participation of the private sector in research lies in the reduced availability of capital and lack of entrepreneurship specific to research field.

The situation is aggravated by the ambiguity of legislation related to the possibility of paying researchers from the framework of state institutes from the attracted extra-budgetary funds.

Scientific performance may be covered by:

- Research grants won in national competitions;
- International research contracts;
- National contracts;
- PhD theses;
- Articles published in scientific journals;
- Books, manuals and monographs published by national and international publishers;
- Patents or other intellectual property products;
- Conference proceedings (summaries and papers published in volumes) etc.

A research evaluation study must take account of economic and technological trends, of education and legislation aspects, of opportunities and risks (threats).

Research, development and innovation activity can be controlled by the following criteria:

- the use of funds allocated from the state budget for research and development;
- private sector contribution to research and development effort;
- qualitative development of research and development infrastructure;
- optimal stabilization of the research structures and their orientation towards competitiveness and efficiency;
- youth participation in research-development projects.

Research policy in the Republic of Moldova pursues creation of an organizational and legislative framework like the one of the advanced countries.

Currently there is a tendency to carry out an increasingly broader specter of economic activities, even those traditionally performed as current activities, in the form of projects, considering that this type of organization provides results at a greater speed and efficiency and facilitates a better control of the resources used.

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