American Journal of Economics and Business Management

Vol. 7 Issue 5 | pp. 51-54| ISSN: 2576-5973
Available online @https://www.globalresearchnetwork.us/index.php/ajebm

Economic Prerequisites and Factors of Organizational Structures for Management of Research and Development in the Field of Integration of Science and Education

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Citation: Abdurakhmanova M.A. Economic Prerequisites and Factors of Organizational Structures for Management of Research and Development in the Field of Integration of Science and Education. American Journal of Economics and Business Management, 7(5), 51-54. Retrieved from https://globalrsearchnetwork.us/ind\ex.php/ajebm/article/view/2763

Received: 17 2024
Revised: 17 May 2024
Accepted: 24 May 2024
Published: 31 May 2024

Abstract: *The article presents the features of the organizational structures of research and development management when using its integration chain "science-education-implementation-pilot production-business", analysis of the formation and development strategy in the national economy of Uzbekistan.*

***Keywords**: stimulation, research institutes, innovative technology, scientific and technological progress (STP), cluster.*

Introduction

integration of education, science and production are becoming increasingly practical. Science and technology, constituting an element of the productive forces of society, are one of the main conditions for social progress, and science becomes fully a direct productive force. The integration of education, science and production contributes to the formation of new social relations. Advances in science and technology in a number of industries are gradually changing the nature of workers' work. Labor in production turns into a function of managing complex systems of machines and units and becomes the most important principle of society. If we want the achievements of science and technology to be quickly implemented and new methods of work applied accordingly, it is necessary that economic bodies, the Academy of Sciences, and Ministries not only propagate them, but identify and eliminate specific difficulties that hinder scientific and technological progress. In this regard, the creation of the Ministry of Innovative Development in the Republic of Uzbekistan was timely and appropriate. It helps to implement the achievements of science and scientific research into production.

Literature Review

In the work of Andreeva O.S. "Development of an innovative economy based on the transformation of the knowledge-intensive sector", the problem of economic development is solved through the use of advanced technologies in knowledge-intensive industries. Here the emphasis is on turning knowledge into a leading factor in economic growth. It is proposed to build a new innovation infrastructure capable of integrating the interests of science, education, government and business [1.p.46], but in these works the problem of financing IR is not considered. In the work of Irina Dezhine and Alexey Ponomarev [2.p.17-18], the creation of scientific and technical innovation involves the use of government regulation based on an iterative model of the innovation cycle (fundamental, applied research, development, implementation, sale). Here we are talking about the desire to actively support not only specific projects, but also the education system and fundamental sciences. In this work, the cluster approach is not considered. The relevance of our research lies in the use of new methods and ways of organizing work and improving existing management systems to form a cluster approach to the introduction of science and technology achievements among young people

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Research methodology

Thanks to the introduction of new technical means into production, the most efficient and reasonable use of material goods and labor resources of society is ensured. This in turn helps to increase the efficiency of all sectors of the economy. To improve the efficiency of economic sectors, it is necessary to ensure that production results grow faster than their costs. To do this, science and production must flow into a single channel, complementing each other. From this point of view, the problem of integration and its appropriate direction is of particular importance. But on the other hand, it is necessary to pay attention to the scientific organization of labor, to methods of planning research work.

The connection of science with production should be facilitated by methods of planning research work, a system of material incentives and an organizational structure for managing research and development.

This problem and its development are inextricably linked with the study of issues of organizing the management of R&D (scientific research development) in higher educational institutions, research institutes, design bureaus and pilot enterprises.

Acceleration of scientific and technological progress puts forward as one of the urgent tasks the development of issues of improving the organizational structure of management in relation to academic research institutes, design bureaus and corresponding areas of higher educational institutions. What is meant here is that higher education was in the same chain with science and production.

Within the framework of this study, economic aspects are particularly important, meaning the choice of the most rational ways to improve quality results and reduce costs by improving organizational structures, especially since these issues are not sufficiently developed in the economic literature.

Currently, in the Republic of Uzbekistan, special attention is paid to the development of instrument engineering and microeconomics. In particular, the Institute of Semiconductor Physics and Microeconomics aims to create sensitive receiving-converting and other elements for microelectronics, photonics and micro-electromechanical systems.

However, in order to ensure high rates of production growth in these most important industries of the Republic, it is necessary to accelerate the introduction of the latest scientific and technical achievements that influence all aspects of the production process and, above all, reduce the unit costs of labor and materials in the production of products. Today, special emphasis is placed on the production of imported replacement devices and materials.

The purpose of our research is to give science-based recommendations for improving the organizational structure of management of academic institutions with design bureaus and education based on the integration of the functions they perform within a single cycle, which will speed up the implementation of research achievements in production and increase its efficiency in the studied sectors of the economy of the Republic of Uzbekistan.

To achieve this goal, using the example of the Research Institute of Semiconductor Physics and Microelectronics at the National University of Uzbekistan, we have set ourselves the following tasks:

1. The first task is to effectively and interconnectedly organize the management structure of the entire chain: education - scientific research - development - implementation - production, so that there is harmony in all these areas. This, in turn, significantly improves the quality of manufactured products and, accordingly, their cost will decrease.

2. The second task is to develop methodological issues of forming an organizational management structure for an academic institute and the associated design bureau based on the consistent implementation of the principle of integration of the main, auxiliary and managerial functions they perform, determining its impact on production efficiency in the studied sectors of the country's economy.

To solve the first problem, we carried out the following work step by step:

1) Research the relevant labor-intensive sectors of the Republic's economy, determine their needs for our scientific developments.

2) It is necessary to select gifted students from among the students of universities of the Republic studying in these areas for the purpose of their in-depth training in this qualification at NIIFPM.

3) For further in-depth training of young specialists in the field of semiconductor physics and microelectronics, create a "Basic Department of Semiconductor Physics and Microelectronics" on the basis of NIIFPM.

The practice of advanced research, design and technological institutions shows that one of the most important sources of increasing the efficiency of their work is the improvement of organizational structures. The possibility of using progressive forms of division and cooperation of labor of researchers and developers, the correctness of their placement, and also increasing the efficiency of using their labor largely depends on the

degree of rationality of the organizational structure.

In this regard, an urgent task is the transition to such organizational structures of these institutions that ensure a reduction in time and an increase in the quality of research and development, while simultaneously reducing the costs of their implementation.

Improving the organizational structure of management and the planning system for the activities of scientific organizations involves, first of all, increasing the role of long-term plans, developing comprehensive scientific and technical programs in the latest areas of science and technology, as well as programs for the scientific and technical development of regions.

Science should become a real support for the region, providing it with the necessary personnel and developing its educational and scientific potential.

Increasing the efficiency of the organizational management structure, improving various forms of communication between education, science and production require the development of methodological materials and standards for managing the entire cycle "education - research - development - implementation - production". In order for this entire chain to work interconnected and synchronously in the same amplitude, a clear, comprehensive scientific and technical program is required that takes into account this entire mechanism as a single whole.

It should be noted here that in industrial research institutes they are mainly engaged in applied research, in contrast to them in academic research institutes and design bureaus, research is exploratory in nature and requires a larger number of experiments, samples of new equipment and technology and requires for its solution a very operational approach to the course of action, and the existing organizational management structures came into conflict with the new requirements.

The specificity of academic research institutes and design bureaus is intersectoral, i.e. their results are used in various industries, increasing the scale and efficiency of the practical use of results and developments in the national economy. This can be considered using the example of the Research Institute of Semiconductor Physics and Microelectronics, which was created at the National University of the Republic of Uzbekistan named after Mirzo Ulugbek. The results of this Institute can be used in mining and metallurgy, instrument making, the defense industry, agriculture, medicine, customs service, and the automotive industry. There are many such institutions in every Republic.

Increasing the efficiency of these institutes, on the one hand, depends on the employees who work in these institutes. Young professionals who come to work from university cannot immediately cover this entire cycle.

In higher educational institutions, the emphasis is mainly on theoretical materials, and their connection with science and production is not always taken into account. This, in turn, creates inconvenience for graduates to quickly adapt when entering production.

Today, engineering graduates still face problems in finding employment, especially when it comes to high-tech industries. Employers themselves see the root of this problem in training programs at universities, which not only do not teach them how to perform a set of specific production tasks, but cannot always give a full understanding of the specifics of production work. The applicants themselves do not understand the fundamental difference between laboratory work, scientific research, for which they were prepared in higher educational institutions, and industrial development, mass production technologies.

Analysis and discussion

To solve this problem, a basic department has been created at the institute. The basic department participates in the implementation of master's programs in production, thereby providing in-depth training for masters engaged in research in the field of semiconductor technology and semiconductor materials science, microelectronics, and digital technology. The basic department will conduct research practical classes, interdisciplinary coursework, final qualifying theses for master's students, and research seminars.

Students engaged in research work at the basic department will be able to apply their scientific research directly into practice and master's theses prepared in this way quickly show their application to industry using the latest equipment.

For this purpose, we studied the experience of the Basic Department of the All-Russian Research Institute of Optical and Physical Measurements (VNIIOFI). If we apply this experience at our institute, then graduates of the master's program of the basic department will receive a set of practical competencies that will help them, after graduation, easily integrate into the work of a high-tech enterprise. Moreover, this will not be a set of highly specialized knowledge and skills, but a set of skills, thanks to which you can start working in production in any of the areas where semiconductor materials, microelectronics and digital technology are used.

The main requirement for bachelor's degree graduates who want to continue their studies and gain a set of practical skills to work in high-tech companies in the industry is to have a basic education in this field. In this case, bachelors who already have experience in

preparing projects may receive an advantage. This type of organization of research, experimental and production work with the integration of education greatly improves the quality and level of education, since close contact is formed between them.

To solve this problem, the first thing we did was to create a "Portfolio of Orders" for future (anticipated) projects in all labor-intensive sectors of the Republic. For this purpose, we created a working group, which included heads of laboratories and department heads and specialists from each organization of national industries. Thus, a Data Bank of initiative projects for the development of the republic was created. Based on this, a project was planned to create a Microelectronic Center at NIIFPM, which consists of two parts, and a research laboratory. The next step was the preparation of proposals for joint work between research institutes and managers of organizations in labor-intensive sectors of the economy.

The next step is the formation of a "Needs Map" of industries in Uzbekistan with a list of:

- Approximate functional orientation of products required by industries (with a description of the consumer value of the product);

- Approximate technical characteristics of these products;

- Development of new methods of control or solving similar problems;

- Relevant R&D for the development of new devices and sensors, as well as controlled automated systems based on them;

- Development and development of equipment and systems;

- Possible mass production of a number of microelectronics products or discrete devices;

- Updating training courses and programs;

-Formation of an experimental research base at the Institute for students, graduate students, and doctoral students.

-Organization of a cluster form of implementation of scientific research projects;

- Drawing up a set of requirements for equipment and technologies in order to create standardized laboratories in the future for the transition to experimental design work.

Since the main direction of NIIFPM is the creation of modern semiconductor devices for various functional purposes with stable and reproducible parameters, in demand in high-tech areas in various sectors of the economy, as well as the development of technologies and research of the parameters of multilayer structures, which are the basic elements of microelectronics and photonics.

For effective work and fulfillment of assigned tasks, each scientific laboratory will be formed strictly consistently with scientific research work.

In the future, NIIFPM will occupy a basic position not only in fundamental and applied research, but also in the development of innovative activities in the region. The institute is forming a laboratory center for collective use with unique scientific equipment; a technological line will be developed, common to all laboratories, which can be used by each of these laboratories as needed. This line provides services for the use of unique equipment and instrumentation, software systems to both scientific laboratories, young scientists, and academic institutes, universities, and industrial enterprises. In addition, the institute creates interactive teaching laboratories and classrooms. A database will be formed on the profile of the research institute and the scientific work carried out. This will ensure the interconnection of science, education and production. Ensuring close integration of the sphere of science and scientific activity with the information space creates an environment of aspiration for science and its attractiveness, attracting young people to scientific activities, training young talents.

In order to familiarize students with scientific news in this field, scientific seminars are held every week at the institute.

In our opinion, such organization of work and comprehensive planning, corresponding to management, contributes to the effective work of scientists and closely closes the connection "education - science - research - development".

During the study, it turned out that in order for this system to work interconnected with production, it is necessary to develop a classification of scientific research and engineering work, covering the entire cycle of "education - research - development - implementation," including fundamental research conducted by an academic institute. To do this, the existing classification of scientific research and engineering work in research institutes and design bureaus needed to be reconstructed in relation to labor-intensive industries, and thus we solve the second task we set.

Conclusion

Based on the developed organization of integration, it is possible to scientifically substantiate the feasibility of a cluster approach to the chain "education – research –

development – implementation", stimulating employees of research institutes and design bureaus for the final results of their activities, taking into account their contribution to raising the scientific and technical level of the younger generation and their mastery of industrial skills .

This, in turn, creates a new type of organization of work for researchers in managing research and development carried out by an academic institute in collaboration with a university and design bureau based on the principle of integrating the functions they perform, as well as studying the economic aspects of implementing this idea.

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