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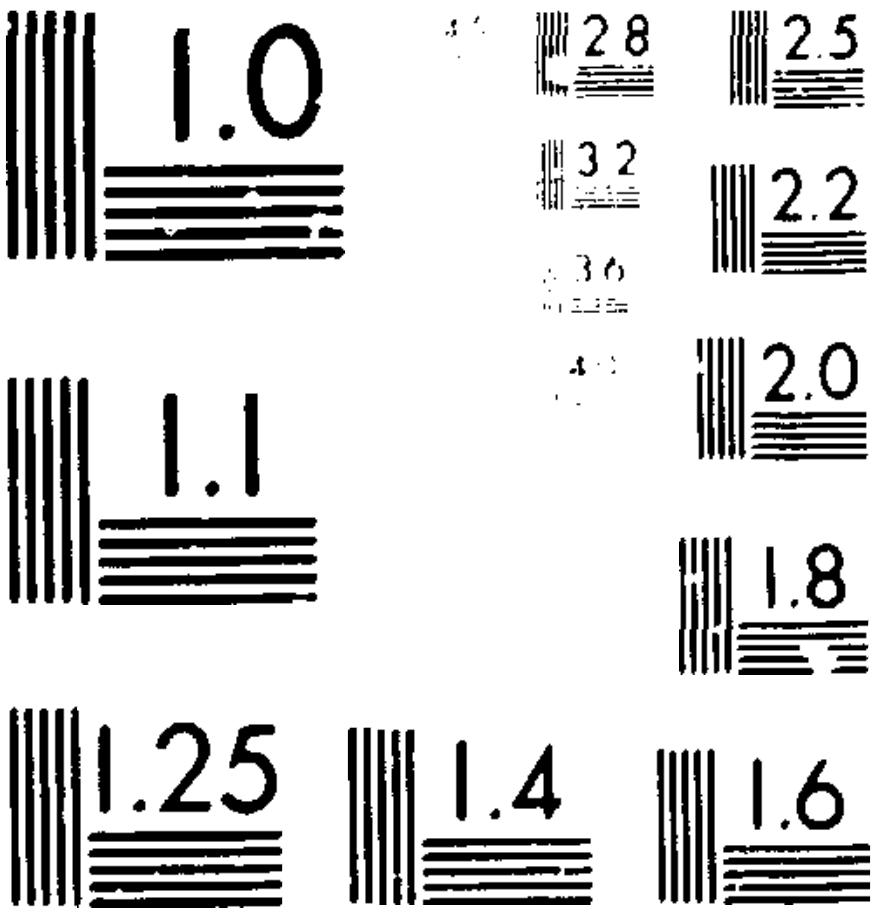

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EXPERIENCE AND PROBLEMS IN INTEGRATION OF EDUCATION IN BULGARIAN HIGHER EDUCATION INSTITUTES WITH RESEARCH AND PRODUCTION*

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Under the conditions of the scientific and technical revolution, the training of specialists with higher education is closely connected with the processes of research investigations and production.

Unifying of the three activities - education, science, production brings to the formation of well trained graduates with possibilities for a quick realization in life.

The architect of the New Educational System in the People's Republic of Bulgaria, Todor Zhivkov, Chairman of the State Council set the task of training of many-sided image of our young graduates.

The achievement of this task requires the Higher Educational Institute to be changed into a compax educational - research center and the training process into a training research one which imposes full utilization of the scientific potential.

The role of the Higher Educational Institute (HEI) for the development of science and technical progress has two aspects. HEIs on the one hand train highly qualified specialists on the other participate actively in the R & D activities and in the implementation into production which appear to integral parts of the training process.

The development of the training process and training of highly qualified specialists as well as the enhancement of the teaching staff qualification cannot exist without active and purposeful research work.

The Educational Reform in the People's Republic of Bulgaria is a naturaly result from the socialist development of the country and the great cares taken by the Bulgarian Communist Party. The economic, social and organizational factors which played an active part in the occurred changes are as follows:

- the rapid rates of building of the material and technical base of the socialist society in our country
- the new economic conditions in our country
- the accelerated development of the scientific and technical revolution

- intensified international scientific and technical cooperation and in particular the integration among the socialist countries
- the necessity of connection of research work with ne training of university graduates.

The absolute volume of the research work in HEI grows incessantly, as in the last 5 - 6 years it has grown four times. The results applied in the economy of the country brought to a significant economic effect.

This is easy to explain. In the 30 HEIs of Bulgaria, 40% of the scientific potential of the country and a greater part of the research workers having academic rank are concentrated.

The HEIs and in particular the technical ones contribute actively in the realization of the up-to-date trends of the scientific and technical progress. Some examples: the developed technologies for ionic nitrogen treatement and carbonizing of parts and instruments under the conditions of low-temperature plasma; the bacterial method of obtaining of cooper concentrate from poor ores; the new types of polymer materials; the new technologies in textile production for chemical fibres of high quality; technologies for obtaining protein; the new families of reduction gears in machine-building industry are developed by research teams at the Higher Institute of Mechanical and Electrical Engineering, the Higher Institute of Chemical Technology, the Higher Mining Institute, the Higher Institute of Machine-building mechanization and electrification of Agriculture etc.

In 1980 the teaching personnel in the HEIs received about 40% of the author's certificates in the country.

A close relating of the training process with research work of the students was initiated and the training process started to change into a training-research one. A Decree of the Council of Ministers of the People's Republic of Bulgaria created preconditions for organization of production activity at the HEI, enabling the student to participate not only in the production but in the management of the training-experimantal facilities and plants too. In this way the HEI enter the sphere of material production and realize development activities of teachers and students.

To close the cycle "research-production" the HEI are in functional integration with the R & D organizations and industrial enterprises. This continuity of the process is secured by the state plans for research & implementation of the attained results. State plans envisage also the problems and tasks for development. The harmony between the objectives followed by research work and customer's demands allows the research teams to find a proper place in the scientific service of national econom,.

The direction followed in the last years to apply research results in the different branches of the national economy gained recognition. A special organization to direct this activity was established with the HEI and the Council on Higher Education. Today more than 35% of the research results find wide application in production bringing both economic and social effect for the country. During the last year for 1 Lev, invested into research work an average profit of 4,41 Leva was received.

The direct economic effect from research and an objective of the development work in the HEI. This compels the teaching staff to take up with the solving of important and actual problems of production and bring the results from research work to implementation. On this ground a better relation between training and science with production is acheived. The social effect of the research work carried out in the HEI however has a greater significance. This is due to the positive effect of R & D activity on the education of young university graduates and young research workers. Research work is an indispensable precondition for raising the level of training to that of modern science.

More than 20 years now active research work under contract with enterprises and production and production organizations is carried out in the HEI through the research departments. This organizational form of integration of planning financing and stimulation of R & D with practice is of an essential importance for the development of research work. The vitality of the contract system is proved in life. The gained experience, enabled us to estimate better the role of research sector which became an integral part in the structure of the HEI. It is

not an organization of the teaching staff, but it is a part of the HEI for implementation of social orders by the State Committee of Science and Technical Progress, economic enterprises and organizations.

Basing on the accumulated experience the objectives, problems and character of research work can be defined more clearly. Thus certain misinterpretations can be avoided, which could lead to contradiction of the educational and research work at the HEI to the other research institutions. It is well-known that the education of young people is carried out better when training and research work are combined adequately. That is so, not only because of keeping to the old traditions but because an organic necessity for the higher education and science has to be satisfied.

Having in mind the peculiarities of the HEI as a training-research organization, the main objectives of the research work can be outlined:

- enrichment of science and production with new scientific achievements
- keeping up a high scientific level of the educational work with the students and post-graduates
- connection of science and education with practice.

These objectives can be achieved when research work is carried out along the following scientific directions

- investigations establishing the necessities, possiblities and the ways for application of the discovered laws and phenomena in the respective fields of science and practice
- foundamental research work for enrichment of scientific knowledge, for widening of the theoretical and experimental base of research development
- applied investigations and development work on the most actual problems of production
- study and popularization of the socialist building in our country
- creation of training, scientific and methodical facilities for the students, post-

graduates, young research workers, designers etc.

The outlines directions in research work define the HEI as a scientific organization of a more common profile where the strategic investigations and research work are closely connected with the education of university graduates and the practice in this country. This doesn't exclude the HEI from solving the most pressing actual and significant problems of production and keeps them from changing into development organizations.

The material and technical base of the HEI doesn't allow always an independent realization of the cycle "research-production". Most often research work ends with semi-ready results for implementation:

- forecasts, concepts, models, designs and other suggestions for development in certain fields of socialist building;
- new theoretical and experimental data, methods, ideas and theories enriching science;
- instructions, guides and methodological developments adapting known and applied scientific knowledge.
- designs, technological, experimental and other applied-scientific developments which make possible the adoption of new or improved products, technologies, materials, machines, apparatuses, equipments, new varieties of plants live-stock, projects for the organization and management of production, unproved labour safety environment protection, etc.

When, the higher educational institues are not in possession of the necessary material and technological basis to bring their scientific and applied-scientific results to the stage of implementation, they have to integrate their work with appropriate research, development and production organizations in order to complete the "investigation-application" cycle. In this case the educational establishments bear the responsability for the scientific and technical level of their projects and

reserve the right to collaborate and exercise control until the completion of the projects.

That is a reliable, method of integration. It is applied very successfully in our country. However, there still exist inexcusable cases of antagomism among units and, specialts of the HEI and branch R & D and production organizations.

Within the framework of the HEI - R & D organization - production unit cooperation the initiative for a high level of technological progress, scientific research and economic effect rests with the scientific staff of the HEI, that is responsible for the effective application of the achieved results.

These formulations apply not only to the technical departments and laboratories, where the final results are mainly devices, technologies and projects, but to all other scientific units of the HEI, as well. Not less important are the theoretical research work and scientific developments when they meet the necessities of science, culture, public life and material production, These developments become effective when implemented and not if they remain only in the files and even libraries of the HEI.

The organizational and managing structure of the Bulgarian HEI is traditional in accordance with the training activities of the Institute.

The department is a basic organizational unit, which unifies lecturers and other specialists in certain scientific areas and carries out the activities of education and scientific research.

The R & D works on different items and tasks of of complex and other programmes are assigned to temporary scientific teams appointed at the order of the rector. The complex problems and tasks normally go beyond the scope of the particular departments faculties and HEI.

The contradiction between the complex scientific teams and the department structure of the HEI is a serious problem, and a growing attention is payed to it.

One of the ways to overcome these difficulties is to strengten the centralized management the R & D activities; to strengthen the role of the faculty and HEI managements; to organize specialized scientific, developing and operating units, as well as

specialized scientific councils, seminars and other forms of discussions and active scientific communication and practice to engage a wider number of members of the HEI governing bodies in the discussions of the HEI scientific policy and other initiatives, representating HEI as an organized force of the national scientific potential.

In this manner a better integration is attained between the departments of the HEI and the Bulgarian Academy of Science and other scientific organizations.

Comparatively easy and without special reorganizations in the HEI structure - this method adapts the department structure to the contemporary requirements for organization of R & D work. In general, it is accepted by our HEI, but it still has not undergone a wholecome development.

With a view to stimulating the R & D activities, attaining a relevant concentration of scientific resources, facilitating the completion of the "exploration-application" cycle and improving the integration with branch R & D organizations, temporary and permanent specialized units are set up to the HEI:

- problematic R & D laboratories;
- specialized R & D laboratories;
- research and production laboratories;
- design, technological and other development units;
- units for scientific, technical, economic and patent information;
- application groups;
- central operating laboratories;
- computing centers
- plants, experimental bases, workshops and other operating units.

There are 85 problematic and specialized research laboratories established within HEI now, exploring problems and tasks included in the State Plan for scientific and technological progress as well as problems and tasks entrusted by the corresponding branches of national economy.

A matter of essential importance for the right organization and management of R & D work is the unity of the

of the management as well as its co-operation with the other activities of HEI. This problem emerges now, when due to the reduced number of students and the creation of a new subject nomenclature, a lot of lecturers will turn out with a reduced training work-load and will have to be directed to planned scientific investigations.

Under the acting decress in our country the financing of the R & D and implementation activities of the HEI is provided by three resources: the national budget provided under the Technological Progress article; contracts with branch organizations; budget of the HEI itself. On this basis the total plan of HEI is drawn up in three sections:

- Institute's plan, financed by the Institute's budget;
- Branch plan, financed by contracts with branch organizations;
- Organizational plan, financed centrally by the Ministry of Education.

Part of the Institute's investigations are of a prospective importance being connected with the risk of scientific research, their economic effect is often not ensured, but they raise the scientific level of applied research and development work and ensure high standard of training specialists for the country. According to their importance all these tasks and items are included in the Institute's or organizational plan.

The rest of the scientific investigations are accomplished through applied results, which are of direct interest for the branch organizations. These items and tasks are included in the branch plan.

The funds required for the fulfilment of the organizational and branch plans are covered by subsidies intended for science and scientific services, provided through the Council of Higher Education.

These two sctions of the plan comprise complex and other programmes which are accomplished through important scientific and technological developments.

The central financing of the research, development and implementation activities affords an opportunity for leading a scientific policy, which, directs the scientific potential of the HEI to strategic investigations and fundamental research, necessary for our country.

The contracts with the branch ministries and organizations strengthen the applied research at the HEI and integrate these activities with the development and production organizations, which favours the wholesome activity of the institutes.

The proper co-ordination of these two principles in planning and financing the R & D activities is of a basic importance for the complete exploitation of the HEI scientific potential

An essential index for the structure of the personnel in the scientific organizations is the ratio between the number of ancillary personnel and scientific personnel. The proper functional allocation of the duties among the scientific workers and the ancillary personnel is very important for the exploitation to the full of the qualified scientific workers and for the intensification of the research process. In the world practice this ratio is 1:3, but it is smaller for the HEI.

One can hardly take the view that the smaller ratio between the scinetific workers and the ancillary personnel in the educational establishments, than that in the organizations and units dealing mainly with research work, is proper. To consider the students an ancillary personnel is tempting, but dangerous and in a number of cases even harmful. It is the work with the students in the research and training laboratories that needs a highly qualified ancillary personnel, scientific workers and ancillary personnel in the HEI, undertaking research work, receive additional pay which amounts to 40% of their salary as lecturers and employees of the HEI.

Students and post-graduate students also receive a pay, amounting to a scholarship, for participating in R & D activities.

These are some of the positive features and problems of the co-ordination of specialists training in the higher educational Institutes of Bulgaria with R & D and production, which are kindly present to the participants in this meeting.