

D I R E C T I V E S
FOR THE IMPLEMENTATION OF THE HITRA PROGRAM
INVOLVING THE POTENTIAL FOR NATIONAL
SCIENTIFIC RESEARCH

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PURPOSE AND GOALS FOR INITIATING THE CROATIAN PROGRAM OF INNOVATIVE TECHNOLOGICAL DEVELOPMENT

Technological modernization of companies and introduction of advanced technologies or new production and business programs initiate economic development. A model that proved to be indispensable for those processes in successful economies is direct cooperation, i.e. participation of scientists and experts from public and private scientific research institutes and higher education institutions with scientific research focal points in the industry and other economic entities.

A purpose of the Program is to mobilize scientific research potentials and human resources in Croatia in order to create and introduce advanced technologies into the economic sector thus resulting by business success i.e. economic development and growth.

In the Croatian Program of Innovative Technological Development (hereinafter: Program) advanced technology has been defined as knowledge that materialized through production and business processes, products and services, taking a form of skills related to production/procedures, marketing and management in the industry and other economic entities. This knowledge stems from available and activated R&D potentials both in public and private sector of research and development, thus creating basic national resources for achieving permanent progress of technology. Economic growth and development of Croatia in the conditions of technological and economic globalization can no longer be based exclusively on natural resources, common entrepreneurship models, and repetitive production and business processes that do not imply managing the change of technology, i.e. advanced and new technologies in the function of development.

Advanced technology, as knowledge materialized through the use of R&D resources in private and public scientific research sector, is a point of support in the creation of added value to products and services with a market value determined by infrequency and usefulness for a user i.e. consumer.

In this sense advanced or new technology, respectively, as well as technological modernization of a company, implies development and commercial use of the process/procedure/product/service with considerably enhanced added value achieved by the use of knowledge i.e. R&D.

In addition, the efficiency of the Program implementation is measured by the development of strategic and

technological skills at the company, i.e. its ability to offer products and services with a high added value to the market by combining knowledge-based resources.

Unfortunately, the reality of companies in Croatia is restricted to the mere existence, while the importance of R&D is secondary. This has resulted in systematic weakening of economic entities and research in the economic sector, and very poor cooperation between academic community and the economic sector.

According to the estimates of the Ministry of Science and Technology almost 80% of funds of higher education institutions and institutes are provided by the state budget. Due to the decrease of budget funding majority of scientific and particularly technology research has been brought to the edge of feasibility. On one hand the solution is in a considerable and necessary increase of the budget for the development of science and technology, and on the other hand in the establishing of cooperation with the economic sector as a complimentary financial resource, i.e. in the development of strategic partnerships between public and private sector.

Due to systematic weakening of the industrial research sector, implying research in the overall economic production sector, a participation of the industry in financing the overall scientific research in Croatia equals 0.3% of GDP. According to the evaluation by OECD experts this fact indicates an alarming situation in the industrial research, and a need for an urgent revitalization of this sector by a joint effort of both the government and industry. For the sake of comparison, a business sector investment in the Czech Republic in 1995 equaled 0.75%, in Denmark 1.10%, Finland 1.59%, Ireland 0.99%, Belgium 1.09%, while in the US, Japan, Sweden and Korea it exceeded 2% of GDP.

This is why the industrial i.e. commercial institutes employ merely 6-8% of the overall number of researchers in Croatia. To compare, the economic sector of developed western countries employs between 40-70% of researchers. E.g. the average of EU is 50:50, and OECD countries 65:35 in favor of the industry.

This situation bears double negative consequences for the overall development: on one hand for the industry because its development and technology level remain stagnant, and on the other hand for the scientific research sector that has lost a possibility for interaction with experts from the industry, including a possibility of employment in the industry, as well as additional R&D projects for the need of the industry. The result is a brain-drain of a large

number of renowned researchers and experts, often for good. This weakens the scientific and economic basis even further.

These reasons have prompted the Technology Directorate of the Ministry of Science and Technology to propose to the Government of the Republic of Croatia **the Croatian Program of Innovative Technological Development** that emphasizes the use of resources of universities and public institutes for the development of technology in Croatia. Technology development often implies the creation of the economic sector with its growth, international competitiveness and efficiency based on the use of knowledge i.e. R&D materialized in new and advanced technologies. Therefore the primary goal of the Program is to encourage the transfer of knowledge, i.e. technologies from the sphere of science and technology into the economic sector, as well as creative transfer and use of foreign knowledge and technologies (“bridging a gap”), creating cooperation among managers and scholars in solving technology problems in the function of the economic development.

The Program includes two subprograms:

- technology-related R&D projects,
- development of knowledge-based companies.

These subprograms are complementary. The first program includes pre-commercial technology-related R&D projects carried out in scientific research institutions and units. They refer to R&D of advanced and new technologies, as well as strategic and generic research relevant for the development of particular industry sectors and branches of industry. The second subprogram includes development, introduction and commercial use of advanced technologies (processes/procedures, products, services) relevant for the industry i.e. economic entities.

Technology-related R&D projects include pre-commercial development of products and technologies up to the stage of original solutions (prototype etc.), or a pilot stage (background and solution), as well as strategic research linking fundamental science and its application in technology. In this manner, strategic technological skills are created in the industry and economic entities. Technology-related R&D projects are implemented on the principle of cooperation among scientists and experts from both the economic sector and science (public and commercial scientific research institutes and higher education institutions), with emphasized priorities, i.e. preferences for close cooperation with experts from collaborating economic entities.

The second subprogram includes development and introduction of advanced technologies (processes/procedures, products, services) including the development of original solutions (prototype/pilot stage) with the aim of commercial use i.e. the introduction of wider market exploitation and continued production. The Program is aimed at encouraging knowledge-based companies, as well as at technological and business reconstruction of a company, developing strategic partnerships with foreign companies, as well as developing existing and conquering new markets. In principle development-related activities are implemented in small and medium-sized companies and their networks, and if necessary at scientific and research institutions disposing of required equipment and experts. In this manner the results of technology projects or R&D from private and public scientific research sector are applied. A basic instrument for the implementation of this Program in terms of institutions is a network of technology centers composed of the Business Innovative Center of Croatia – BICRO and technology centers within the system of support by the Ministry of Science and Technology.

In this Program technology centers are intermediary institutions intervening in the transfer and commercial use of technologies from science and technology into the industry i.e. into the economic sphere. In addition, by developing not only company's technology-related but also its business skills required for a change in technology, technology centers transfer needs and projects from the economic sector into the academic and technological community, as well as into administrative units, in order to implement joint activities. This is why technology centers can be considered as an essential factor to the regional development, and also as a factor of the national development in certain sectors of the industry or economy, in relation to the intensity of its functional specialization. In this sense the Business Innovation Center of Croatia (BICRO) is the point of integration and joint development of the technology centers network.

Technology Department has decided to start the implementation of *the Croatian Program for Innovative and Technological Development* with the second subprogram due to the following reasons:

- Technology Department has a modest budget that may be sufficient for the start-up of the Program but not for the implementation of technology projects. Their implementation depends on the resources allocated in the future by the Government of the Republic of Croatia.

- The subprogram for development of advanced technologies (products, processes/procedures, services) presents an innovation in the Croatian technology and innovative policy so there is a need for a pilot stage to test criteria and conditions for incentives for the creation of knowledge-based companies.
- This subprogram is also an introduction into the creation of new modes of financing technology development by using seed and other forms of risk capital. This presents a new technology in the area of financing, market development, and technology policy management.
- The second subprogram for development of new products, services, and technologies also includes a development of critical marketing knowledge and technology of access and analysis of existing markets and development of new markets, which is a prerequisite for a real growth i.e. development of knowledge-based companies.
- Finally, the subprogram for development of new products, services, and technologies also includes development of management technology and knowledge applied in up-to-date solutions of organizational issues.

TECHNOLOGY-RELATED RESEARCH AND DEVELOPMENT (R&D) PROJECTS

Purpose and goals of the Program

The purpose of the Program is to decrease a technological gap between Croatia and developed countries through cooperation of the academic community with the industry and other economic entities. This cooperation should be focused to research and development of technologies with a significant economic potential, and to the follow-up and transfer of the recent technology-related achievements and knowledge relevant to the development of Croatia. In addition, the Program includes research and development of advanced technologies (processes/procedures, products, and services), as well as the improvement of existing technologies with a potential for market exploitation.

The goal is to promote cooperation between the academic community (scholars and researchers) and the economy, related to the solution of specific difficulties in terms of technology, production or business operation. The aim is marketing of products, follow-up, and possible transfer of the recent technology-related knowledge, methodology and techniques (“bridging the gap” with devel-

oped countries). It is expected that the final outcome will be a revival of research in the economic sector, i.e. enhancing the existing and the creation of new R&D focal points in the industry using the potential for national scientific research.

The Program includes technology projects focused at research and development of advanced technologies (processes/procedures, products, and services), and technology projects in the field of strategic research.

Expected results

a. Short-term

- quick and efficient support to existing and underfinanced applied and developmental research relevant to direct use in the industry and economy
- stimulating scientists to initiate new R&D technology-related projects that may encourage additional investments by the industry and other economic entities
- new approach to the development of generic and strategic research in science and industry
- revival of research in the industry.

b. Long-term

- permanent cooperation between the public scientific research sector and economic sector;
- systematic development of research in the industry;
- decreasing the technology gap between Croatia and developed countries;
- increasing a general technological level of the economy i.e. improving the present state of techniques and technology;
- creation of new production/business programs, as well as new branches and sectors in the industry and the economy;
- application of knowledge and research in technology and economic development through the creation of products and services with an added value.

Users of the Program

The users of the Program are coordinators of the Program and candidates submitting project proposals.

A project may be coordinated by:

- (a) any legal entity entered into the Register of Scientific Research Legal Entities maintained by the Ministry of Science and Technology;

- (b) any legal entity entered into the Register of Higher Education Institutions maintained by the Ministry of Science and Technology;
- (c) scholars and researchers through an institution or a unit registered for science and research or science and higher education.

A project proposal may be submitted by:

- (a) any project coordinator from the previous paragraph;
- (b) any economic entity and any other legal entity if a coordinator is one of the above mentioned legal entities.

Project financing

The Ministry of Science and Technology will use specially allocated resources to finance the implementation of this subprogram. The subject of financing in this Program will be as follows:

- technology projects focused at research, development, and the adoption of advanced technologies (processes/procedures, products, services);
- technology projects in the area of strategic research.

Technology projects are focused to pre-commercial development of products and technologies up to the stage of the original solution (prototype/pilot stage). They provide background and solutions for the development of processes/procedures/products/services necessary for the start-up of continued production and marketing.

They include only research and development projects that have been assessed to be of interest for the companies and contain real marketing possibilities.

Strategic technology research is research in the background of the so-called engineering or transfer science and generic technology directly creating new products and processes i.e. new or advanced technology. Strategic research is focused to the understanding of basic processes of technology impact, and it uses knowledge from fundamental sciences on one hand, and practical knowledge from engineering disciplines on the other hand, in order to advance or create new products and processes.

Strategic research includes:

1. research and development of generic technologies;
2. research in scientific fields related to transfer.

Generic technologies create technological innovations that can be used in a range of other industries, thus contributing significantly to the productivity of the entire economy. The importance of generic technologies such as information technology and communication technology, biotechnology (biochemistry, molecular biol-

ogy etc.), microtechnology, new materials etc. is in the creation of intermediary products to be build into final products in various branches of industry. In this manner they connect traditional and new production sectors/industries, by generating new sectors/industries.

Transfer (or engineering) sciences such as chemical engineering, pharmacology, agriculture, medical sciences, civil engineering, metallurgy etc. operate as bridges between fundamental sciences and technology, thus shortening the period before the application of fundamental knowledge and technologies. Research in the area of engineering has significant economic potential since it contributes directly to the development of industry i.e. its technological progress, while linked to the contemporary marketing and management technology it considerably shortens the period before the commercial use of the research.

Criteria for project financing

Criteria for project financing are defined by the Technology Field Council. Criteria should reflect the complementarity of the projects with development needs of the economy, and give preference to the following principles:

- scientific research projects;
- economic (market) usefulness;
- the introduction of new or improvement of existing technologies;
- creation and improvement of R & D focal points in the industry;
- development of generic technologies;
- development of scientific fields related to transfer.

Project application

Financing of R&D technology-related projects will be implemented based on a public call for proposals announced by the Ministry of Science and Technology.

R&D technology-related projects are submitted on the application forms for proposing a technology project. The forms are available exclusively on the web site of the Ministry of Science and Technology (<http://www.mzt.hr/>).

Project evaluation

The Ministry of Science and Technology will establish the Technology Field Council to evaluate research and development (R&D) technology-related projects.

The Technology Field Council will be composed of renowned scholars and acknowledged experts from the industry and companies.

Projects must be evaluated not only by scholars but also by experts from the economic sector.

The evaluation of a technology project will be carried out according to the elements of a project proposal defined by the application forms for proposal of a technology-related R&D project.

Application and evaluation of technology-related R&D projects will be carried out following the same procedure and technique as the application and evaluation of scientific research projects.

DEVELOPMENT OF KNOWLEDGE-BASED COMPANIES

Purpose of the Program

The purpose of the Program is to stimulate development of knowledge-based companies and technological modernization of companies by developing existing and/or introducing new production and service programs, primarily by involving national scientific research resources from universities and public institutes. The efficiency of the Program is measured through the level of company's success at the market, so the emphasis of the Program is to stimulate and enhance company's strategic capabilities to achieve competitive advantage and make strategic and investment partnerships leading to continuous growth of production, export and employment.

In addition to the transfer and use of new knowledge, technology, methodology and know-how arising from the national academic community, technology sector and the industry, the Program also implies the transfer of foreign knowledge and technology with the assistance of Croatian scholars and researchers.

Program implementation stimulates and promotes cooperation among scholars and academic institutions with small and medium knowledge-based companies. In addition the Program endorses cooperation with specialized agencies, companies and other supporting institutions in Croatia and abroad with small and medium knowledge-based companies.

A knowledge-based company is a company that has achieved its competitive advantage, technological capability i.e. its development and growth using knowledge i.e. research and development converted into advanced technologies (processes/procedures, services, and products).

Technological modernization of companies implies development of knowledge and skills related to production and service activities, i.e. the introduction of ad-

vanced technologies (processes/procedures, services, products) into the production and business programs or significant improvement of existing technologies. In this manner the company accumulates technological capability i.e. research and development, based on the application of knowledge i.e. R&D. In addition, technological modernization of a company implies development of management and marketing skills necessary for the achievement of competitive advantage.

Goals of the Program

The Program is expected to achieve the following short-term and medium-term goals:

a. Short-term goals:

- start-up and development of new companies based on new or considerably improved technologies (processes/procedures, services, products), and development of the so-called academic entrepreneurship;
- technological modernization of a company, and improvement of its capabilities related to the production, marketing and management;
- creating new jobs, especially for professionals with the associate and bachelor degree;
- improvement and standardization of quality of products and services, and introduction of new or advanced technologies related to products or services;
- identifying potential business partners, development of existing markets and access to new markets;
- development of competitive advantage in international scale with the emphasis on internal growth/development;
- transfer of foreign knowledge and technology and their further development for its own needs;
- stimulating joint cooperation of experts from the entrepreneurial and research sphere;
- start-up of new technology centers, parks and similar institutions in the function of development of technological infrastructure;
- preparation of domestic companies for participation in international programs for development of new technologies such as COST, EUREKA; BRITE-EURAM etc.

b. Medium-term goals

- increasing general technological level of the economy i.e. improving the present state of technics and technology, as well as stimulating the creation of new production programs/branches of industry;

- gradual creation of export-oriented sectors of knowledge-based small and medium-sized companies;
- development of competitive advantage on international scale, relying on internal growth and development or external growth and development (networking of companies), respectively;
- preparation of Croatian companies for the participation in international programs for the development of new technologies;
- support to the development of new private branch of financial industry: seed and interest capital;
- attracting foreign funds involving risk capital (seed and interest capital) and direct foreign investments;
- gradual creation of the national system of innovations and strategic partnership between the private and public sector;
- gaining experience in the use of the so-called technological change for economic development i.e. increasing the profit rate (profitability) based on the use of knowledge, development and research.

Users of the Program

Users of the Program may be:

- a) potential entrepreneurs i.e. citizens of the Republic of Croatia who wish to set up a new company in Croatia, based on development or introduction of a new product or technology;
- b) companies:
 - with a seat in the Republic of Croatia;
 - with prevailing private ownership;
 - independent of management by other companies.

Activities to be financed

Activities to be financed are as follows:

1. development and commercial use of advanced technologies (processes/procedures, products, services);
2. development aimed at technological modernization of a company.

In this Program development implies activities that include development of original solutions (prototypes/pilot stage) in a direct function of the commercial use of a product/service. It also implies the introduction of a product/service into the market and creating the conditions for continued production.

Technological modernization of a company implies the introduction of advanced or new technologies (processes/procedures, products, services) into production pro-

grams or their improvement/modification that differs in important functions from the existing program and therefore presents a new production/business process/procedure, product, service.

Advanced or new technology and technological modernization of a company implies development and commercial use of a process/procedure/product/service with a considerably increased added value that is achieved by the use of knowledge i.e. research and development.

Technology fields

The Program will give incentive to products and services with the increased added value from all fields of production and service activities, particularly if they:

- a) contribute to the overall quality of living:
 - environmental protection and clean production technologies;
 - technologies for saving the energy, materials and natural resources.
- b) belong to generic technologies, e.g.:
 - information and communication technologies;
 - biotechnology (biochemistry, molecular biology etc.);
 - micro- and nano-technologies;
 - new materials;
 - intelligent production systems.

Principles of financing

Funds will be granted for entrepreneurial projects that fulfill the following criteria:

1. technical-technological innovations in terms of creating a product, process or service with a high added value;
2. academic entrepreneurship and/or setting up a company as a continuation of research in an institution engaged in scientific research or science and education;
3. planing or improving cooperation with the university or any other scientific research institution (institute, department etc);
4. developing generic technologies primarily: (1) information and communication technology, (2) biotechnology (biochemistry, molecular biology etc), (3) micro- and nano-technology, (4) new materials etc;
5. developing competitive advantage, especially oriented to the export and strategic partnership;
6. increasing diversification of the structure and scope of financing.

Principles of financing are implemented using the respective criteria, while priority in financing is expressed by weight, thus forming the base for the evaluation process.

The evaluation procedure has been defined by the Regulation on the Procedure for the Implementation of the Program for Development of Knowledge-Based Companies, and on Conditions and Financing of the Program, or Criteria and Activities in the Program Implementation, respectively.

Modes of financing

Funds will be granted based on a public call for proposals announced by the Ministry of Science and Technology, according to the documentation and procedure determined by the Directive for the Implementation of the Program for Development of Knowledge-Based Companies, Criteria and Activities in the Program Implementation, and the Program Budget for a Financial Year.

The Program foresees financing entrepreneurial projects in the form of:

- a. non-repayable funds for research & development activities and expert consultations
- b. financing with favorable repayment conditions
- c. financing with the provision that repayment is required only in case that the project is successful
- d. investment into a share capital of a company
- e. supporting projects through the guarantee funds.

Modes of financing and a repayment guarantee are defined by the Regulation on the Procedure for the Implementation of the Program for Development of Knowledge-Based Companies.

Financing will be implemented through the authorized financial institutions that follow the requirements defined by the contract with the Ministry of Science and Technology.

A public call for proposals will include the preparation of a preliminary application (a short project proposal and documentation), and an application (business plan/investment study) according to the elements determined by the Regulation on the Procedure for the Implementation of the Program for Development of Knowledge-Based Companies, and Criteria and Activities in the Program Implementation.

Authorities responsible for the Program

The authority responsible for the *Program* is the Ministry of Science and Technology.

The Ministry of Science and Technology will entrust the network of technology centers with the Program implementation, project evaluation and monitoring the development of projects. The network is composed of the Business Innovation Center of Croatia (BICRO), and technology centers within the system of support of the Ministry of Science and Technology. Independent consultants and other competent institutions will be involved as circumstances require. BICRO will decide on project financing.

Project evaluation

The evaluation of applications will include the following assessments and procedures:

- (1) (technical review of all elements of a preliminary application and application;
- (2) (expert evaluation of a project according to the elements set by a preliminary application, and business plan/investment study in case of the application;
- (3) (evaluation of entrepreneurial and management skills of the entrepreneur in a final stage of the project evaluation, including an interview with the applicant;
- (4) (rank ordering of submitted projects according to the criteria and priorities for project selection determined by the Regulation on the Procedure for the Implementation of the Program for Development of Knowledge-Based Companies, and Criteria and Activities in the Program Implementation.

Organization and implementation of the Program

The Program will be implemented as follows:

1. preparation of documentation for a public call for preliminary applications and applications, as well as legal and other required documentation;
2. announcement of a public call for preliminary applications and collecting proposals;
3. evaluation of preliminary applications by technology centers;
4. selection of projects that can start the elaboration of the application (business plan/investment study);
5. evaluation of applications;
6. contracting entrepreneurial projects;
7. financing entrepreneurial projects;
8. providing systematic support to the companies within the Program;
9. systematic monitoring of the implementation of entrepreneurial projects within the support system;

10. achieving the so-called output (applying exit mechanisms) for the companies within the system of financing their ownership capital.

The Ministry of Science and Technology reserves the right to propose modifications of the Directives and related documents on its own initiative or on the initiative of any participant in the Program. The modifications will be approved by the Interdisciplinary Control Committee.

FOOTNOTE

* The Government of the Republic of Croatia has accepted on April 5, 2001, the following documents that make a legal framework for the current technology and innovation policy under the responsibility of the Ministry of Science and Technology:

1. Croatian Program for Innovative Technological Development (HITRA), adopted by the Government of the Republic of Croatia on April 5, 2001;
2. Guidelines for the Implementation of the HITRA Program Involving the Potential for National Scientific Research, adopted by the Government of the Republic of Croatia on April 5, 2001;
3. Regulation on the Procedure for the Implementation of the Program for Development of Knowledge-Based Companies, Official Gazette of the RH, No. 33/2001.