

THE REPUBLIC OF CROATIA
THE RUĐER BOŠKOVIĆ INSTITUTE
Public Scientific Institute of the Republic of Croatia

DEVELOPMENT STRATEGY
OF THE RUĐER BOŠKOVIĆ INSTITUTE
2017–2023

INTRODUCTION

In 2003, the Ruđer Bošković Institute (hereinafter: the Institute) adopted the Strategic Program for the Scientific Research of the Ruđer Bošković Institute, 2013–2018. By the end of 2016, the Institute had implemented a major part of the strategic objectives of said strategic program. At the same time, owing to new circumstances and opportunities for the further development and advancement of the Institute, the Institute adopted a new document, Development Strategy of the Ruđer Bošković Institute, 2017–2023.

MISSION AND VISION

The Institute is the largest Croatian scientific research center of a multidisciplinary character.

The Mission of the Institute is excellent scientific research in the natural, biomedical and engineering sciences, with contributions to higher education and cooperation with the business sector based on outstanding scientific research.

The vision of the Institute is to be a recognized top European center of scientific excellence.

ANALYSIS OF SCIENTIFIC POTENTIAL

The Institute participates in numerous internationally and nationally financed and internationally peer-reviewed scientific projects, such as those within the framework of the program Horizon 2020, programs of the IAEA, FP7, Croatian Science Foundation (HrZZ), NATO, NSF, ICGEB and projects of other foreign scientific foundations. The Institute is currently engaged in over 200 projects, for which over half of the total funding is from European Union projects and other international sources. Table 1 presents the performance of the Institute in the projects within Horizon 2020 and the EU Framework Program (FP). The Institute also has capital scientific research equipment valued at over 100 million HRK. Furthermore, the Institute is the leading institution in the Republic of Croatia in terms of number of papers published in international scientific journals, especially in the category of the most prestigious journals (Figure 1).

The Institute, with its research capacities, knowledge and scientific excellence, has assumed the role of linking science with the business sector of the Republic of Croatia. A multidisciplinary approach is one of the key strengths of the Institute, which provides comprehensive solutions for a broad spectrum of socially important issues.

Program	Number of Projects	Value in EUR
FP5	2	311,800
FP6	20	3,140,238
FP7	33	11,279,820
Horizon 2020	13	7,034,125

Table 1. The number and value of RBI projects financed from the EU FP European Commission programs and Horizon 2020.

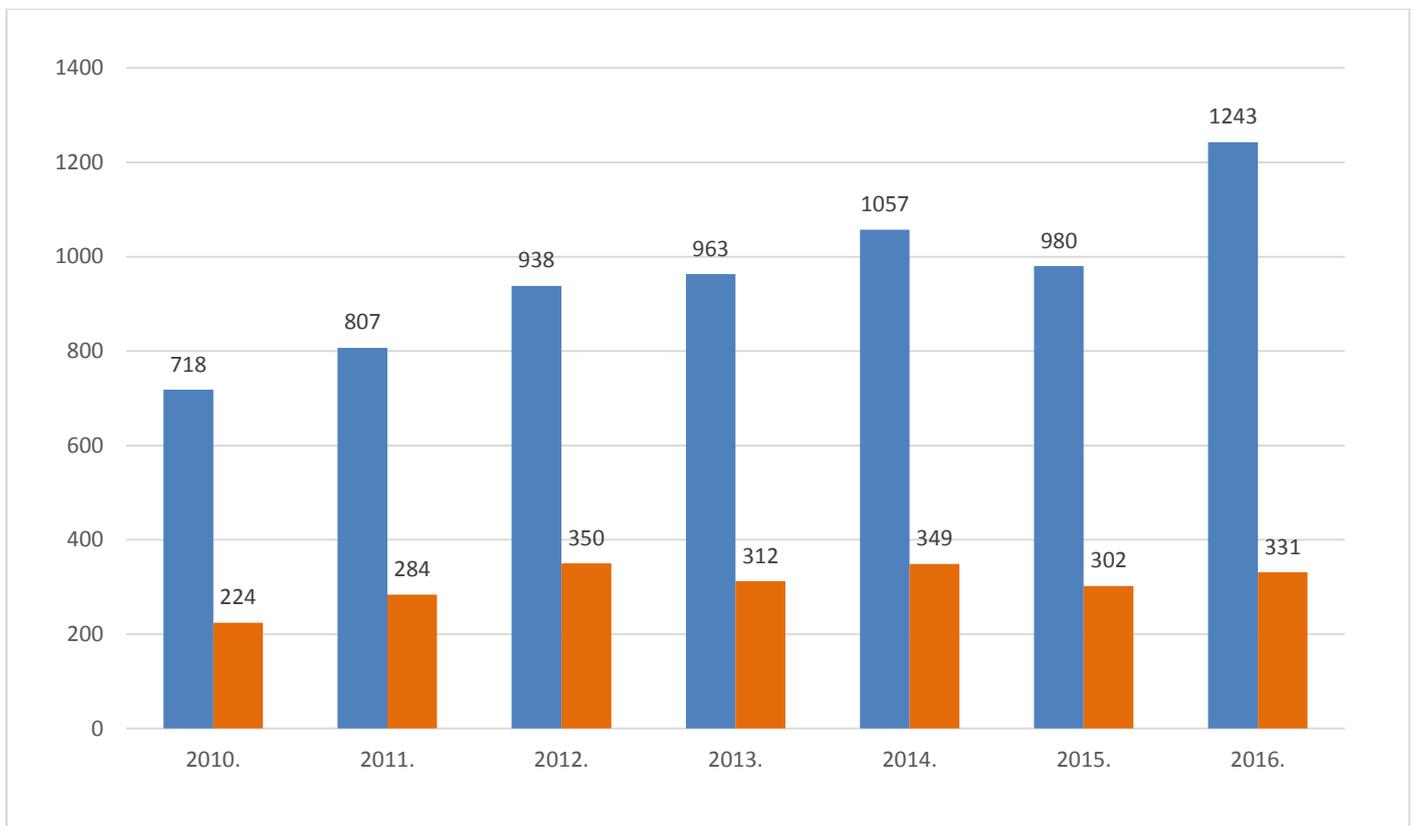


Figure 1. The number of scientific papers published by the Institute (orange columns) and all the institutions in the Republic of Croatia (blue columns) in journals with impact factors in the upper 25% (Q1) in individual scientific fields, according to *Journal Citation Reports*. In the data for 2016, the 2015 impact factors of journals were used (the latest available).

ENVIRONMENT–SWOT ANALYSIS

The credibility of the precepts presented in this document and the likelihood of meeting the targets presented in the following chapters cannot be assessed without insight into the national, regional and international environments. Therefore, this document provides a summary of a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the scientific potential of the Institute and the position of the Institute in the scientific and business environment.

Strengths

- In terms of size, scientific productivity, internationally recognized research and the quality of the scientific personnel and research equipment, the Institute is the most significant scientific institution in the natural sciences, biomedicine and environmental research in the Republic of Croatia.
- The concentration of scientific personnel and equipment qualifies the Institute at the national level and, in some cases, also at the regional level, as a competitive place for conducting demanding interdisciplinary and multidisciplinary research.
- Distinguished researchers and/or laboratories of the Institute have achieved significant international recognition through world-class scientific work.
- Owing to the large number of potential mentors and qualified researchers, as well as the relatively

modern research equipment, the Institute is still an attractive place for the best students from Croatian universities to pursue doctorates, which continue to provide an influx of qualified doctoral candidates.

- The Institute is the leading and internationally most competitive national institution with respect to competence and experience acquired through participation in international research projects (Horizon 2020, FP7, IAEA, NATO, NSF, ICGEB and other foreign scientific foundations, as well as in international peer-reviewed projects of the Croatian Science Foundation (HrZZ). Scientists are appointed to positions at the Institute on the basis of public tender and assessment of the candidates conducted by competent colleagues according to the criteria of excellence, with the necessary letters of recommendation by distinguished foreign scientists. Postdoctoral experience working in an international environment is a significant advantage for appointment to a scientific position.
- The Institute has implemented measures that stimulate scientific excellence and reward project success, as well as collaboration with the business sector and support for scientific returnees to the Republic of Croatia.
- At the national level, the Institute provides unique support and technical expertise in certain priority national tasks.
- The Institute has implemented flexible organization and management of the organizational units, depending on the project successes of a scientist. The administration of the Institute has adapted to the increased scientific and economic activities of the Institute. The Department for Projects and Knowledge Transfer has been introduced, the procedure for hiring foreign scientists has become easier, the Construction Investment and Maintenance Department has been introduced, which is essential for the successful implementation of projects financed from the structural funds of the EU.
- The Institute has a high quality Public Relations Office, traditionally organizes Open Days at the Institute and maintains intensive communication with the media.

Weaknesses

- The poor state of the infrastructure at the Institute (obsolete buildings and installations, part of the scientific instrumentation is worn out or obsolete, the lack of space for experiments etc.) has a direct impact on the quality and international competitiveness of the research but also on the ability to obtain the appropriate accreditation and cooperation with the business sector.
- There are an insufficient number of scientists with strong reputations in the world scientific community, as well as an insufficient number of international scientific collaborations led by scientists from the Institute.
- A lack of technical support hampers scientific experimental advances in areas characterized by conducting complex development projects.
- Due to insufficient investment in science and the scientific infrastructure, the Republic of Croatia is increasingly lagging behind European science and opportunities for obtaining competitive international projects are decreasing.
- There is a lack of flexibility in the allocation of positions.
- There is an insufficient number of doctoral and postdoctoral students.
- There are difficulties in hiring quality technical and administrative staff due to noncompetitive salaries.

Opportunities

- The funding available from the EU Structural Funds represents an exceptional opportunity for the Institute. By devising quality projects in collaboration with the Ministry of Science and Education,

other ministries, the state administration, universities, other scientific institutions, local governments and/or the business sector, the RBI can significantly improve its scientific, economic, space and infrastructure capacities.

- European Union funds for research and development frequently require the participation of scientific institutions from as many member countries as possible. The Institute has the possibility of presenting itself as a strategic international partner from the Republic of Croatia to a large number of scientific institutions and, thereby, increase its contribution to international projects. Through the leadership of international projects to date, the Institute has acquired the experience and knowledge needed for such strategic positioning.
- The scientific staff can be strengthened through increased hiring of the best Croatian scientists working in other countries. By hiring high quality returnees, new research directions are opened that follow trends in the international scientific community.
- The best graduates of universities in Croatia and neighboring countries should be attracted.
- There should be strong commitment by representatives of the Institute at all levels to improve budgetary funding, which should be in line with the strategic objectives of the Republic of Croatia.

Threats

- Obsolete and demotivating national legislation in the fields of science and higher education
- Excessive bureaucracy of the responsible bodies and inadequate government procedures for the successful and rapid implementation of projects financed from the EU structural funds
- Further reductions in investments in science in the Republic of Croatia
- The increasing number of graduates and scientists who continue their careers in foreign scientific institutions and are demotivated by the current situation in the Republic of Croatia
- The obsolete educational model in the Republic of Croatia
- The uncompetitive and inflexible salary system for scientific and technical personnel
- Complicated rules for the employment of scientists and associates whose academic degrees were acquired outside the Republic of Croatia

STRATEGIC OBJECTIVES OF THE INSTITUTE

The strategic objectives of the Institute for achieving its vision of development are as follows:

1. Improving the quality of scientific research
2. Improving the structure of scientific and nonscientific personnel
3. Improving the quality of cooperation with the business sector
4. Improving the infrastructure
5. Systematic participation in higher education
6. Raising the quality of resource management and administrative support
7. Popularizing science and promoting the Institute
8. Strengthening the role of the Institute in the creation of the scientific policy of the Republic of Croatia

PLAN FOR ACHIEVING THE STRATEGIC OBJECTIVES OF THE RBI FOR 2017–2023

The Institute has developed a plan to continue to further its strategic objectives until 2023, taking the new circumstances and objectives already achieved into account.

1. Improving the quality of scientific research

Continued improvement in the quality of scientific research will be achieved through the continuation and strengthening of activities for creating an atmosphere at the Institute that promotes internationally competitive quality basic research in the fields of the natural, biomedical and engineering sciences, by following the positive experiences of the world's leading research institutions.

Full implementation of the priorities of the European Research Area will be achieved by encouraging competition, transparent and open recruitment and advancement policies, as well as by open access to scientific equipment and other resources of the Institute.

The development of a flexible organizational system, management procedures and evaluation of scientific work will continue that support and encourage international competitiveness, publication in leading scientific journals, scientific results of major international impact, a leading and active role in international scientific collaborations, and a leading and active role in internationally financed and internationally peer-reviewed projects.

Through the allocation of program funds, development coefficients and laboratory space on the basis of excellence, the Institute will support and encourage research groups able to secure the funding of scientific research through competitive projects.

The divisions of the Institute have the right and obligation to determine strategic research directions independently, while respecting the aforementioned basic principles of the Institute.

The Institute supports internationally competitive basic research in the fields of biology, physics and chemistry in the scientific area of the natural sciences; in the fields of basic medical sciences, veterinary medicine and pharmacy in the area of biomedicine and healthcare; in the field of the interdisciplinary natural sciences; and in the fields of electrical engineering and computer science in the area of the technical sciences.

The Institute sees the future in the strengthening of interdisciplinary research that can provide added value to the scientific work at the Institute and enhance the international reputation, social role and position of the Institute in the Republic of Croatia. Owing to the unique multidisciplinary nature among the scientific institutions in the Republic of Croatia, the Institute is a particularly suitable institution for interdisciplinary and multidisciplinary research in response to the strategic challenges of today and the Institute will take maximum advantage of its position.

In the 2017–2023 period, the emphasis will be on interdisciplinary research in the area of the natural sciences (chemistry, physics and biology), biomedicine and healthcare (medical science and veterinary medicine), and technical and biotechnical sciences (biotechnology) in order to address the challenges in the thematic priority areas of the Strategy for Smart Specialization:

- health and the quality of life,
- energy and sustainable environment,
- food and bio-economy,
- security, and
- traffic and mobility.

In addition to these thematic priority areas, emphasis will also be on the horizontal priorities of the Strategy for Smart Specialization: key enabling technologies (KETs) and information and communications technologies (ICTs).

Accordingly, interdisciplinary research will be conducted at the Institute:

- a) in the areas of chemistry, biology, biomedicine and bioinformatics that have the goal of meeting challenges in medicine and biotechnology, drug manufacture, food and ecology;
- b) focused on solving complex problems in connection with the sea and environment, including chemical, biological, mathematical, biochemical, geological, veterinary, medical, physical and oceanographic research;

- c) in the areas of physics and chemistry that have the goal of preparing new materials and sensors, the development of analytic techniques for their characterization and the expansion of knowledge in the area of photonics and radiation technologies;
- d) the development of e-sciences with applications in various fields, such as bioscience, biotechnology, biomedicine, materials science and the modeling of complex systems.

In achieving this strategic objective, as well as most of the other set goals, projects to be financed from the European Regional Development Fund have a significant role. In the coming period, strategic priority will be afforded to Open Scientific Infrastructural Platforms for Innovative Applications in the Economy and Society (O-ZIP), the Maritime Experimental Center of Biodiversity (MOREXpo) and the Centers of Scientific Excellence.

2. Improving the structure of scientific and nonscientific personnel

The Institute is a leader in the scientific community of the Republic of Croatia when it comes to stringent requirements in the hiring of scientists. With the new Regulations on Additional Prerequisites for Appointment to Scientific Positions, which follow the positive experiences of the best scientific institutions, excellence will be even more emphasized. The Institute will strive for the requirement for all research associates to perform postdoctoral study for a minimum of one year at a prestigious scientific institution in a foreign country. The Institute will not apply the legal option of extending employment after conditions for retirement are met for the purpose of rejuvenating the staff and facilitating the recruitment of the best postdoctoral students to scientific positions, and well as for the purpose of attracting top young Croatian scientists from foreign countries. For active and internationally distinguished scientists, the Institute will provide for the continuation of scientific activity as external associates or scientists emeriti.

In the long term, the Institute must establish a broader employment policy in order to continue to raise scientific quality and facilitate the successful execution of strategic projects, such as O-ZIP and MOREXpo, and provide support to projects within the framework of the programs of Horizon 2020, Centers of Scientific Excellence and other major internationally financed and business projects. For long-term development and improving quality, the Institute will facilitate greater flexibility in the redistribution of employment positions.

3. Improving the quality of cooperation with the business sector

Knowledge, expertise and a multidisciplinary approach to solving a variety of problems, project tasks and services available in the many laboratories and divisions of the Institute create great potential for cooperation with the business sector. Therefore, in the coming period the Institute will strongly support initiatives in the sector of research, development and innovation (projects of the Competence Research Sector - CRS) and the participation by scientists from the Institute in the proposals of centers of competence.

The newly adopted regulations on intellectual property, established to provide the inventor with much greater freedom and flexibility over his idea, is still another step toward improving the commercialization of knowledge.

An important influence on the achievement of this strategic goal will be through the realization of the project Strengthening the RBI System for Knowledge Management and Research Commercialization, which was ordered by the Central Finance and Contracting Agency for the Programs and Projects of the European Union (CFCA) that are financed through structural funds.

The project should contribute to positive changes at the RBI through the revision of all the strategic documents and is connected with the O-ZIP project. The objective of the project is to improve the organizational processes and procedures at the Institute in connection with the management of intellectual property and the portfolio of research projects, encourage the commercialization of research results through improving the knowledge and skills of Institute employees and improve communication with all the shareholders of the system of the commercialization of research results, together with the raising of public awareness concerning the importance of the Competence Research Sector.

4. Improving the infrastructure

The most important step for improving the infrastructure at the Institute in the near future will be through the projects O-ZIP and MORExpo. The Institute will also use every other opportunity that arises through national or international funding in order to improve the scientific infrastructure.

O-ZIP was chosen at the end of the year 2014 as a priority project of the Republic of Croatia, which was confirmed by the EU through the adoption of the Operational Program of Competitiveness and Cohesion of the Republic of Croatia, 2014–2020, and this as the only such project based on the STEM areas. In the year 2016, O-ZIP formally became part of the adopted Strategy for Smart Specialization of the Republic of Croatia.

In terms of content, the project includes infrastructure work on the construction, expansion and adaptation of objects and investment in capital scientific equipment, primarily at the location of the headquarters complex of the Institute in Zagreb and, to a lesser extent, at the location of the Martinska Research Station in Šibenik.

The basic argument for the project is that strengthening the core activities and research infrastructure of the Institute (modernization of the equipment and working areas of the existing organizational units) and forming “research infrastructure platforms” creates bridges toward the European Research Area, business sector, the scientific and academic communities and the society as a whole. This facilitates greater applicability (including commercialization) of research, stronger interdisciplinary collaboration, synergy of added values and continued institutional growth of the Institute.

The objectives of the project **MORExpo** are to strengthen the international competitiveness of the Center for Marine Research/Ruđer Bošković Institute as a center of scientific excellence, raise the quality of basic and targeted research in the area of blue biotechnology and create the conditions for improving the commercialization of the results of such research through the modernization of the scientific research infrastructure and improving its technological level. Through the implementation of the project MORExpo, the building in Rovinj will be updated and a new research ship and other essential scientific equipment will be purchased.

5. Systematic participation in higher education

The Institute participates in bachelor's, master's and doctoral studies at Croatian universities and promotes the development of high quality doctoral programs. The Institute is also in the process of entering into cooperation with several European universities.

The Institute will adopt a strategy of participation in maintaining teaching at all levels: bachelor's, master's and doctoral. The objective is to strengthen the social role of the Institute through increasing the quality of the education of students in the Republic of Croatia, especially the doctoral candidates of the Institute, and increase the competitiveness of science in the Republic of Croatia on the international level, as well as protect the rights of Institute employees involved in teaching.

The Institute will also attempt to obtain the right to conduct independent doctoral studies.

6. Raising the quality of resource management and administrative support

The Institute anticipates a major increase in its activities through the structural and additional projects within the framework of the program Horizon 2020 and other competitive projects, and planned increased cooperation with the business sector. This also implies an increased need for support activities connected with mobility and public procurement, as well as legal support, project monitoring, financial analysis and the like.

A key measure for improving the aforementioned activities was the adoption of the Regulations on Job Structure. This document establishes the rights, duties and authorities of all the members of individual services.

Additional measures include greater investment in the education of personnel in the services, continued analysis and identification of the work of services and, accordingly, the promotion of the best employees. In this regard, Regulations on Incentive Measures have been issued that regulate the mechanism for motivating the best employees.

The informatization of the RBI will continue and all the services will be merged into one system.

7. Popularizing science and promoting the Institute

The Institute is highly engaged in the popularization of science and the dissemination of the results of scientific work at the Institute. In addition to Open Days, which are now held every year, the Institute actively promotes competitors for the Science Olympics, cooperates with secondary schools and at all levels successfully popularizes the Institute, scientists and their successes, and also provides exceptional support to the conferences conducted by the Institute. These activities will be intensified in the coming period.

The Institute also wants to establish itself as a recognizable scientific-educational center in the Republic of Croatia. For this purpose, it has adopted a plan for the establishment of an interactive scientific laboratory. Such a laboratory, under the auspices of the Institute and top experts, would provide professors, mentors and gifted secondary school students with practical workshops, training and preparation for the Olympics.

8. Strengthening the role of the Institute in the creation of the scientific policy of the Republic of Croatia

During the 2013–2016 period, the Institute independently underwent profound restructuring, which had a major impact on fostering scientific excellence and project success, structural flexibility, attracting the best scientists and improved collaboration with the business sector. The Institute, therefore, owing to its experience, can successfully help the scientific community in the Republic of Croatia with the creation of a much more competitive scientific system. Moreover, the Institute is ready for partnership cooperation with the relevant ministry, local community, government administration and all other relevant stakeholders.

ANTICIPATED OUTCOMES FROM ACHIEVING THE STRATEGIC OBJECTIVES OF THE INSTITUTE

- The Institute will be a top multidisciplinary research institution, which in the next five to ten years will become a recognizable European center of excellence in research within the scope of its activities, and will enjoy strong and sustainable cooperation with the business sector.
- The Institute will improve the quality of the research personnel. The international experience and mobility of researchers, especially doctoral and postdoctoral students, and the establishment of a suitable system for hiring and advancing the best young scientists will be key levers of development, and the RBI will become a more desirable and attractive institution for the recruitment of talented young scientists, as well as returnees from foreign countries and foreign scientists.
- The Institute will be an institution of the open type. The equipment and scientific infrastructure of the Institute will be accessible to scientists from all the other public scientific institutions in the Republic of Croatia who, in cooperation with scientists from the Institute, will ensure the maximum utilization of equipment for internationally competitive scientific work. The equipment will also be available to the business sector.
- The Institute will be an institution that will intensify cooperation with the business sector. Moreover, the Institute will encourage and support the transfer of knowledge, innovations and technologies, as well as the commercialization of the results of top research projects.
- The Institute will become an institution with high quality administrative support, research programs and simple, clearly designed and computerized administrative procedures.
- The Institute will have a major international component, both in terms of the number of foreign researchers and number of international projects.

- The Institute will be financially stable, with sufficient funds to enter into new major scientific and business ventures.
- The Institute will have a key role at the national level in the popularization of the sciences and raising awareness about the importance of knowledge and scientific research for the development of the society.