Stairway to Excellence
Cohesion Policy and the Synergies with the Research and Innovation Funds

Example of Synergies

Latvian Institute of Organic Synthesis

Latvia

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**Executive Summary**

Latvian Institute of Organic Synthesis (IOS) is one of the leading research institutions in Latvia and the biggest beneficiary in Latvia from FP and H2020 programmes. IOS received the best score among all Research Organizations in Latvia in “Research Evaluation Exercise”, which is a part of the international project “Latvia in Innovation System Review and Research Assessment Exercise”. So it is not surprising that IOS is the best performer in using and attracting research funding on a competitive basis – successfully participating in SF and FP calls. For example, IOS attracted 24% (€11.9m) of all financing granted to project partners from Latvia in FP programmes during the period of 2007-2013, according to data provided by National Contact Point.

IOS is participating in several FP and SF projects. For the purpose of the case study only projects where synergies can be found are included. Projects included in this case study are ongoing at the time of preparation of this fiche and have delivered intermediary results. Frankly it means that this report assesses synergies occurred instead of synergies planned. It is valid to assume that the scale of the synergies will be greater than the ones shown in this report when projects will be finished.

The main benefit from the different funding programmes and the synergies created were due to the combination of the infrastructure investment funded by SF and research funded by FP7. Infrastructure subsequently has been used in the research projects funded by FP and SF(ESIF). Eventually, synergies partly are the result of the design of the programmes. However, synergies can be seen as a result of strategic activity and active use of the programmes’ opportunities by IOS. It shows that a wide range of opportunities and support create an enabling environment for synergies.

SF and FP support was mutually reinforcing. We can see in the case that without SF and FP funded infrastructure it would be impossible for IOS to participate in several research projects. Thus, SF funded infrastructure complemented infrastructure funded by FP.

However, these synergies are not directed by the design of the programmes. The case shows that enabling and provision of a variety of funds might be a sufficient condition for building effective synergies for the organizations with strategic vision.

**Type of synergies**

In the case study the following synergies between SF and FP7 were identified:

- Upstream and downstream
- Sequential and parallel funding

**S&T field targeted by the synergies**

- Health, Nanosciences & Nanotechnologies,
1. Introduction

The case presented in the following sections is one of the examples of synergies provided by the ‘Stairway to Excellence’ project in which different sources of funding have been combined to amplify the R&I investments and their impact on the economy and wider society.

As described in the guide ‘Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes’, synergies can be achieved through:

- Sequential (or successive) funding that use funds in separate projects built on each other;
- Parallel funding that use funds in separate projects complementing each other;
- Simultaneous/cumulative funding that brings together Horizon2020 and ESIF funds in the same project aimed at achieving greater impact;
- Alternative funding that reorients FP7/Horizon 2020 projects that were positively evaluated, shortlisted, but not funded given the limited budget, towards Structural Funds impact.

The combination of sources of funding is used to address two types of activities:

- Upstream activities build the appropriate capacities to perform research. They can be capacity building in physical capital (construction or improvement of research infrastructures, purchasing equipment, (including IT equipment and connections, data storage capacities), innovation infrastructures (LivingLabs, FabLabs, Design factories, etc.) and social capital (assistance for building networks, clusters and consortia).
- Downstream activities are focussed towards the market and the creation of economic value. They can be applied to research, development and demonstration activities, technology transfer and adoption; technology and innovation audits to identify potential demand for RDI results; proof-of-concept funding; pilot lines for first production; and pre-commercial procurement projects. There can also be activities to support the improvement of the innovation eco-system in a territory.

2. **Context**

Latvian Institute of Organic Synthesis (IOS)\(^2\) was established on 02 January 1957 in order to perform research in organic chemistry, molecular biology and bioorganic chemistry. IOS has long and positive experience in drug design and technology development, namely 17 original drugs were discovered and introduced into the market, more than 70 original preparation methods of known medicines were invented. Presently IOS has on-going projects with 11 pharmaceutical companies. Together with business partners more than 270 patents have been filed in the last 5 years. The results achieved in the fundamental research have also been reflected in 4 monographs, 20 brochures, 464 articles in scientific periodicals and 406 abstracts of reports. 23 Doctor’s theses were defended during this period. In addition IOS received the best score among all Research Organizations in Latvia in “Research Evaluation Exercise”\(^3\).

The Institute of Organic Synthesis is involved in the fundamental studies in the field of organic (O-, S- and N-heterocycles, betaines), bioorganic (peptides, membrane active substances), organoelement (organic compounds of silicon, germanium, tin, metal complex catalysis) and physical organic chemistry (NMR, ESR, mass spectroscopy, X-ray structure analysis, electroanalytical chemistry).

A new laboratory dealing with the analysis and certification of medicines has been established in 1996. Four new laboratories have been organized in the Department of Medicinal Chemistry (CNS active compounds, Pharmaceutical pharmacology and Organic chemistry – in 2001, Advanced technologies of organic synthesis – in 2003).

The institution settled in Riga, Latvia. The staff numbers 312 persons, including 180 researchers, 9 members and corresponding members of Latvian Academy of Sciences.

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\(^2\) Information in this section is taken from [http://www.osi.lv/](http://www.osi.lv/)

3. IMPLEMENTATION

Figure 1 maps the project chronologically, the research activities of the organisation and the type of funding. It aims to give a picture of relations between projects revealing planned or unplanned dependencies (synergies) between projects and their source of funding.

**Figure 1: Diagram of chronology of the main projects involved in synergies**

As seen in the diagram above, there are several interactions between the projects. Infrastructure financed by ESIF (SF funded Project 1) facilitates possibility to become a partner in the R&I activities of FP7 and Horizon2020 projects (see table 1); namely,

- ENABLE (European Gram Negative Antibacterial Engine).
- NABARSI “New Antibacterials with Inhibitory activity on Aminoacyl-tRNA Synthesis”
- EuroNanoMed project “CheTherDel” (FP Funded project 2)

InnovaBalt project is used to promote research results of the successor projects financed by ESIF. In this way, four European Social Fund (ESF) and three European Regional Development Fund (ERDF) projects are realised (details are available in section 4). Furthermore, InnovaBalt also promotes the upstream activities by means of acquired scientific equipment for the projects.

4 [http://www.imi.europa.eu/content/enable](http://www.imi.europa.eu/content/enable)
6 Projects ENABLE and INTEGRATE are not included in details in this study because these projects were at the early stage research at the time of preparation of this study.
Table 1. Project synergies and output relation to other projects

<table>
<thead>
<tr>
<th>Outputs</th>
<th>NABARSI (FP7)</th>
<th>ENABLE (IMI)</th>
<th>InnovaBalt (FP7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Equipment</td>
<td>Scientific equipment used for the research.</td>
<td>Scientific equipment used for the research.</td>
<td>Possibilities for cooperation and networking with the leading outstanding NMR centres in Europe</td>
</tr>
<tr>
<td>Renovated research laboratories</td>
<td>Laboratories used for the research.</td>
<td>Laboratories used for the research.</td>
<td>- Adapted premises for the infrastructure acquired within InnovaBalt project.</td>
</tr>
</tbody>
</table>

Besides, InnovaBalt project provides synergy with EU Structural funds via offering possibilities for cooperation with the leading outstanding Nuclear Magnetic Resonance (NMR) centres in Europe, which is essential for research on new NMR 11 equipment acquired by means of the SF funded Project 1. Infrastructure financed by InnovaBalt (FP Funded Project) enables research in the SF Funded project "Contribution of human resources in the synthesis and studies of practical applications of new heterocyclic anticancer agents and diagnostic tools" (SF Project 2). Particularly, InnovaBalt project financed the purchase of Zetasizer Nano ZSP system to perform studies of nanoparticles and to determine the molecular weight of proteins. During the period from June, 2014 till February, 2015 acquired equipment was extensively used for (1) studies and characterization of nanoparticles formed by cationic self-assembling compounds (funded by the European Social Fund and (2) EuroNanoMed, project "CheTherDel" (FP Funded project 2).

The ‘synergy chain’ works very well and, at the same time, infrastructure enables participation in Horizon 2020 projects as well. Participation in Horizon 2020 projects in turn increases the international exposure of an organization and will lead to excellence; thus it increases the return on investment in infrastructure.

Parallel funding has also realised through ESIF and FP programmes. Infrastructure financed by ESIF (SF Funded Project 1; Timeframe: 2011-2015) complements infrastructure financed by FP7 in project InnovaBalt (Timeframe: 2013-2017), increasing the values of both investments. InnovaBalt project financed the purchase of hybrid CPU-GPU computer cluster to establish a platform for structure-based drug design. The purchase also allowed performing large-scale molecular dynamics simulations of protein-inhibitor complexes to account for protein mobility during the design of optimized structures. In addition, IOS have acquired the license of GAUSSIAN software package within the European Regional Development Fund co-financed project "Implementation of the International Research Assessment Exercise recommendations". The software package will allow chemists to perform quantum mechanical calculations of chemical reactions and reaction products and will enable detailed studies of the reaction mechanisms and prediction of product physicochemical properties.

**Added value / complementarities created by the synergies**

The case study shows how investments from different funding sources can be used to reinforce the impacts on LIOS research capacity. Funding from structural funds creates a base for participation in international research programs; thus it allows building scientific excellence of the organization.

The infrastructure investment from SF and from FP creates complementarities and increases scope and effectiveness of application of each investment. Moreover infrastructure subsequently is used in the research projects funded by FP and SF(ESIF).
We can see that in the case without SF and FP funded infrastructure it would be impossible for IOS to participate in research projects. Thus, SF funded infrastructure increased the usefulness of infrastructure funded by FP and vice versa. Apart from that, InnovaBalt financing from FP increases the value of R&D activities by promoting dissemination and commercialization of the knowledge in the broader EU market.

**Mechanisms facilitating the synergies**
Main mechanism facilitating the synergies is strategic planning at the level of the research organization. It shows how the bottom-up initiative is meeting a variety of funding opportunities. Without scientific excellence and clear goals of the organization as well as strong management commitment towards excellence, such synergies would not be created.

Eventually, synergies are not created by the design of the programmes, but more by strategic activity and active use of opportunities by IOS. It shows that a sufficient range of opportunities and support creates an enabling environment for synergies.

**Main problems encountered in implementing the synergies**
Due to the difficulties to obtain two funds in parallel, the organization abandoned several activities. More specifically, IOS was intended to combine funding from ESIF for the activity "Support for International Cooperation Projects in Science and Technologies" (2.1.1.2) and FP7 fund in order to have necessary funding of the international conference. The reason to combine funding sources was that funding provided by ESIF activity was not sufficient to finance all the costs. Due to the risk of double funding it was not recommended by Managing Authority to use such scheme, despite the fact that IOS was ready to provide necessary co-financing for both funds from its financial resources.

**Suggestions to improve the synergies**
First, bureaucratic and administrative procedures should be designed in a more flexible way to allow for synergetic and complementary use of various funding sources. Second, to facilitate complementary use of financing, the timing of calls and coordination of various programmes at the national and EU level could be improved.

**Main motivations in implementing the synergies**
The main motivation for combining various financing sources in synergetic way is to derive maximum return from the investments in infrastructure, research and personnel.

**Facilitating mechanisms for the take up of the scientific results**
- IOS has IPR manager position responsible for Intellectual property management
- IOS extensively uses funding to advertise and disseminate research results. International exposure is necessary in order to find collaboration partners in research. Apart from others, InnovaBalt funding is used for these purposes.

**Impact on the regional / national economy**
Within the scope of projects financed by EU SF, IOS has developed several new technologies and drug candidates for the local pharmaceutical industry. Thus, facilitating the creation of new high value – added products as well as fostering employment increase in the region.
Figure 2 aims to position projects according to the activities they cover; from upstream (infrastructures, equipment, research activities) to downstream related activities (innovation, knowledge transfer, access to market).

**Figure 2: Diagram of the complementarities of the funds in the knowledge triangle / flow**

- **SF Project 1**
  The development of research infrastructure for the State Research Centre of Pharmacy and Biomedicine

- **SF Project 2**
  Contribution of human resources in the synthesis and studies of practical applications of new heterocyclic anticancer agents and diagnostic tools

- **FP Project 1**
  «InnovaBalt»

- **FP Project 2**
  «CheTherDel»

- **Research**
  (Research infrastructures, facilities, research activity)

- **Training**
  (Continuous professional training, PhD fellowships)

- **Innovation**
  (Knowledge dissemination, knowledge transfer events, funding of the KTOs etc.)
4. RELATED PROJECTS

SF PROJECT 1: “The development of research infrastructure for the State Research Centre of Pharmacy and Biomedicine.”

Project number: No. 2011/0045/2DP/2.1.1.3.1./11/IPIA/VIAA/001
SF Funding scheme: 2.1.1.3.1 “Development of Scientific Infrastructure” of the Complement of the Operational Programme “Entrepreneurship and Innovations.”

Budget:
- EU contribution: €11.3m (IOS share of the project)
- IOS contribution: €2.4m


The aim of the project is to develop modern regional infrastructure for research activities related to biomedicine, drug discovery and pharmacy and to contribute to the development of research potential in Latvia. The project will cover costs for construction and reconstruction of research facilities (including IOS), purchase of research equipment.

The primary outputs of the project so far are the purchase of scientific equipment as well as the renovation of research laboratories.

SF PROJECT 2: “Contribution of human resources in the synthesis and studies of practical applications of new heterocyclic anticancer agents and diagnostic tools.”

Project number: ESF project No. 2013/0002/1DP/1.1.1.2.0/13/APIA/VIAA/005
ESF Funding scheme: 1.1.1.2.0 Social Fund project Program ‘Human resources and employment.’

Budget:
- EU contribution: €449 thousand.
- National contribution: €49 thousand.


The project is committed to promoting new heterocyclic compound design with an outlook to their potential applications as new anti-cancer medicines and diagnostic tools and development of innovative synthetic methods and technologies. Design and studies of the substances which can form nanoaggregates to promote drug delivery processes into cells is also included.

The project aims at improving human health, quality of life and increase in active economic life extension. Conversely, the use of nanotechnology related to innovative materials having a broad development and industrial level.

FP PROJECT 1: “InnovaBalt”, „Strengthening the research and innovative capacities of the Latvian Institute of Organic Synthesis, the leading Baltic regional centre for drug discovery.”

Project number: GA – 316149
FP funding scheme: Research Potential (REGPOT-2013-1)

Budget:
- Budget €5.26m
- EC contribution: €4.71m

Time frame of the project: 2013-2017 (length 42 month)

The general objective of the InnovaBalt project is to strengthen the multidisciplinary research capacities, management of intellectual property, as well as human resources in the innovative drug discovery at Latvian Institute of Organic Synthesis (IOS). The project implementation will ensure the
contribution of IOS in the socio-economic development of Baltic region and increase the visibility of
the IOS research potential in European Research Area.

**Project home page:** http://www.innovabalt.eu/

InnovaBalt project is used to promote research results of the following projects financed by ESIF:

- a. European Social Fund project No. 2013/0037/1DP/1.1.1.2.0/13/APIA/VIAA/003, Stereoselective synthesis of exocyclic C=C double bond containing compounds,
- b. European Social Fund project No. 2013/0002/1DP/1.1.1.2.0/13/APIA/VIAA/005, Contribution of human resources in the synthesis and studies of practical applications of new heterocyclic anticancer agents and diagnostic tools;
- c. European Social Fund project No. 2013/0026/1DP/1.1.1.2.0/13/APIA/VIAA/006, Total synthesis of cytotoxic natural products;
- d. European Social Fund project No. 2013/0003/1DP/1.1.1.2.0/13/APIA/VIAA/009, Investigation of the fatty acid energy metabolism to develop novel diagnostic tools and treatments for the cardiovascular diseases;
- e. European Social Fund project No. 2013/0069/1DP/1.1.1.2.0/13/APIA/VIAA/011, Elaboration of the condensed azines as effectors of anti-cancer drugs;
- f. European Regional Development Fund project No. 2014/0017/2DP/2.1.1.10/14/APIA/VIAA/060, Design and development of complex N-containing heterocyclic systems as potential chemotherapy drugs;
- g. European Regional Development Fund project No. 2014/0019/2DP/2.1.1.10/14/APIA/VIAA/062, The development of anti-malaria drug candidate;
- h. European Regional Development Fund project No. 2014/0015/2DP/2.1.1.10/14/APIA/VIAA/064, Synthesis of new anticancer immunomodulators.

**Inputs from other projects used in this project creating synergies**

InnovaBalt project financed the purchase of hybrid CPU-GPU computer cluster to establish a platform for structure-based drug design and to perform large-scale molecular dynamics simulations of protein-inhibitor complexes to account for protein mobility during the design of optimized structures. In addition, IOS have acquired the license of GAUSSIAN software package within the European Regional Development Fund co-financed project “Implementation of the International Research Assessment Exercise recommendations”. The software package will allow chemists to perform quantum mechanical calculations of chemical reactions and reaction products. Software package and the computer cluster will enable detailed studies of the reaction mechanisms and prediction of product physicochemical properties.

**FP PROJECT 2: “CheTherDel.”**

**FP/National Funding scheme:** Nationally funded ERA-NET scheme of the Seventh Framework Programme of the European Commission, Research Directorate-General, Grant Agreement No. 321570

**Budget:**
- Total cost: €120thousand. (IOS share of the project)
- National contribution: €120thousand.

**Time frame of the FP funded project:** 2011–2017 (length 42 month)

The primary aim of the project is to combine synergistically nano-theranostics principles with targeted chemo-thermal-delivery, by use of customized microwave energy.
The project focuses on the development of pharmaceutical nanocarriers. Diverse, innovative nanomagnetic assemblies will be designed by modifying materials, size and surface properties and tested in hepatocytes from rats in cell culture for their general toxicity and their specific influence on the proteome. The project will combine nano-theranostics principles with targeted chemothermal-delivery, by use of customized microwave energy in a 2-stages therapy. The physicochemical and toxicological data will be correlated with findings from the microwave targeting efficiency in-vivo in rats, to allow establishing benefit-risk estimation for the various nano-assemblies tested in successive trials. Separately, the particles will be tested for their effect on human hepatocytes in cell culture in order to know whether correlations can be established that simplify a later screening.

ONGOING & FUTURE PROJECTS:

Infrastructure financed by ESIF (SF funded Project 1) facilitates possibility to become a partner in the R&I activities of FP7 and Horizon2020 projects.

- **ENABLE (European Gram Negative Antibacterial Engine)**
  - Starting date: 01/02/2014
  - Ending date: 31/01/2020
  - Total budget (with IMI funding): €85 million (€58.9 million from IMI)
  - Organisations & Countries: 32 partners (including 11 SMEs) from 13 countries

- **Innovative Training Network grant in Horizon 2020 call: “Interdisciplinary Training Network for Validation of Gram-Negative Antibacterial Targets” (INTEGRATE)**
  - Starting date: 01/01/2015
  - Ending date: 01/01/2019
  - Total budget – EU contribution: € 2 793 330.72
  - Organisations & Countries: 10 beneficiaries from 8 EU MSs

- **NABARSI "New Antibacterials with Inhibitory activity on Aminoacyl-tRNA Synthesis”**
  - Starting date: 01/06/2013
  - Ending date: 31/05/2016
  - Total budget (with EU contribution): € 5 389 151.8 (€ 4 102 157.5 from EU)
  - Organisations & Countries: 5 partners from 4 countries

- **EuroNanoMed project “CheTherDel” (FP Funded project 2)**
  - Project length: 2011-2017 (length 42 months)
  - Total cost: €120 thousand. (IOS share of the project, all from national funding)
  - Organisations & Countries: 5 partners from 4 countries

InnovaBalt project is used to promote research results of the following projects financed by ESIF:

- **Stereoselective synthesis of exocyclic C=C double bond containing compounds**
  - (European Social Fund project No. 2013/0037/1DP/1.1.1.2.0/13/APIA/VIAA/003);
  - EU funding: €448,850.6
  - National funding: €48,155.68
  - Cooperation partner funding: €63
  - Project beginning date: 01/09/2013

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9 [http://www.imi.europa.eu/content/enable](http://www.imi.europa.eu/content/enable)
b. **Contribution of human resources in the synthesis and studies of practical applications of new heterocyclic anticancer agents and diagnostic tools** (European Social Fund project No. 2013/0002/1DP/1.1.1.2.0/13/APIA/VIAA/005);
   - EU funding: €448,850.6
   - National funding: €48,155.68
   - Project beginning date: 01/09/2013
   - Project ending date: 21/08/2015
   - Cooperation partner: Riga Technical University

   - Cooperation agreement amount: €21,001.23

   c. **Total synthesis of cytotoxic natural products** (Social Fund project No. 2013/0026/1DP/1.1.1.2.0/13/APIA/VIAA/006);
   - EU funding: €448,847.76
   - National funding: €48,155.67
   - Cooperation partner funding: €68.07
   - Project beginning date: 01/11/2013
   - Project ending date: 30/06/2015
   - Cooperation partner: Latvian Biomedical Research and Study Centre

   - Cooperation agreement amount: €22,691.96

   d. **Investigation of the fatty acid energy metabolism to develop novel diagnostic tools and treatments for the cardiovascular diseases** (European Social Fund project No. 2013/0003/1DP/1.1.1.2.0/13/APIA/VIAA/009);
   - EU funding: €446,817.63
   - National funding: €47,938.82
   - Project beginning date: 01/09/2013
   - Project ending date: 28/08/2015
   - Cooperation partner: Latvian Biomedical Research and Study Centre

   - Cooperation agreement amount: €51,324.41

   e. **Elaboration of the condensed azines as effectors of anti-cancer drugs** (European Social Fund project No. 2013/0069/1DP/1.1.1.2.0/13/APIA/VIAA/011);
   - EU funding: €448,850.6
   - National funding: €48,155.68
   - Cooperation partner funding: €153.97
   - Project beginning date: 01/09/2013
   - Project ending date: 31/08/2015
   - Cooperation partner: Latvian Biomedical Research and Study Centre

   - Cooperation agreement amount: €241.89

   f. **Design and development of complex N-containing heterocyclic systems as potential chemotherapy drugs** (European Regional Development Fund project No. 2014/0017/2DP/2.1.1.10/14/APIA/VIAA/060);
   - EU funding: €378,553.62
   - National funding: €40,614.45
   - Cooperation partner funding: €227.66
   - Project beginning date: 03/01/2014
   - Project ending date: 31/08/2015
   - Cooperation partner: Latvian Institute of Aquatic Ecology

   - Cooperation agreement amount: €76,034

   g. **The development of anti-malaria drug candidate** (European Regional Development Fund project No. 2014/0019/2DP/2.1.1.10/14/APIA/VIAA/062);
   - EU funding: €448,850.74
   - National funding: €48,156.95
   - Cooperation partner funding: €241.89
   - Project beginning date: 02/09/2013
o Project ending date: 31/08/2015
o Cooperation partner: Latvian State Institute of Wood Chemistry
o Cooperation agreement amount: €80,534.54

h. **Synthesis of new anticancer immunomodulators** (European Regional Development Fund project No. 2014/0015/2DP/2.1.1.1.0/14/APIA/VIAA/064);
   o Project application is rejected
ANNEX – DETAILS OF THE RELATED PROJECTS

SF FUNDED PROJECT 1

Project title: The development of research infrastructure for the State Research Centre of Pharmacy and Biomedicine, 2011/0045/2DP/2.1.1.3.1./11/IPIA/VIAA/001

Weblink: www.osi.lv

Beneficiary: Latvian Institute of Organic Synthesis

Type of institution: Public Research Organization

Budget
- EU contribution: €11.3m (IOS share of the project)
- IOS contribution: €2.4m

SP funding instrument:
- Funding scheme: Structural Funds Operational Programme “Entrepreneurship and Innovations.”
- Subprogram: 2.1.1.3.1 “Development of Scientific Infrastructure”
- Call for proposal: Second call ending Sept-2011


Main project objectives
The aim of the project is to develop modern regional infrastructure for research activities related to biomedicine, drug discovery and pharmacy and to contribute to the development of research potential in Latvia. The project will cover costs for construction and reconstruction of research facilities (including IOS), purchase of research equipment.

Specific goals
- Scientific equipment
- Renovation and construction of research laboratories

Collaborative work within the project
- Project partners:
  - Latvian University
  - Riga Technical University
  - Latvian Biomedical Research and Study Centre

Type of costs covered
- Following costs were covered by the project:
  - Renovation and construction of research facilities: €4.9m
  - Scientific equipment: €8.7m

Main Results (intermediate results at the time of case study)

Beneficiary – Latvian Institute of Organic Synthesis:
- Flow reactor for process research and substance development;
- Parallel synthesis equipment to optimize the reaction conditions to 250ml volume;
- Large capacity (up to 20L) synthesis machinery for raw material development and process research;
- Equipment for measurement of concentration of known substance in a complex matrices pharmacological research support and impurities quantitative content determination of chemical compounds;
• Equipment for metabolism analysis, connectivity identification with high-resolution mass spectrometry methods, impurity profiling;
• Machinery for LC/MS service analysis to increase permeability flow;
• Sample pre-processing machinery for bioanalytic sample flow capability increase;
• Draught closet and laboratory installment in the new building (gas lines, computer network, commutator installation);
• Reagent storage furnishing (current storage facility renovation) ~300m²;
• Liquid chromatography mass spectrometry machine with control and data processing software for chemist use in synthesis laboratories;
• Gas chromatography machine with flame ionization detector, control and data processing software;
• Polarimeter for small substance amount analysis;
• Preparative high effectiveness liquid chromatography machinery with UV detector and fraction collector;
• Preparative “flash” chromatography machinery with equipment;
• Nuclear magnetic resonance spectrometer Service (200 MHz) renewal;
• High frequency nuclear magnetic resonance spectrometry machinery with an opportunity to study high molecular compounds - proteins, polymers;
• Protein expression laboratory equipment for KMR experiments;
• Equipment for research of sorption thermal effects;
• Construction works for creating a large quantity synthesis laboratory and deployment of the current autoclave;
• New building's synthesis laboratory part;
• Renewed existing laboratories’ communication systems (ventilation, water supply, sewerage, electricity, heating system);
• Renovated existing laboratory building;
• Furnished construction site territory of the project;
• Renovated existing laboratory building facade;
• Equipment for purified (reverse osmosis) and ultra-clean (18.2 MW / cm, TOC ~ 2 ppb) water abstraction, storage and distribution to laboratory facilities;
• Animal housing facilities;
• Equipment for washing animal cages and crates;
• Specialized furniture (ventilated tables, inhalation anesthesia);
• Shared manipulation premises;
• Technical support for cell banks. Hardware that automatically provides necessary conditions for long-term storage;
• Tiny machinery (Centrifuges, homogenizers, ~80 refrigerators);
• Behavioral experiments’ equipment;
• Physiology laboratory equipment (modernized equipment for research of isolated organs and an in vivo rat physiology);
• Microdialysis equipment;
• Equipment (10) for automatic blood specimen collection;
• Oxylad graph with accessories;
• Scintillation counter for measuring the quantity of radioactive isotopes;
• Cell sorting equipment activated with fluorescent dyes (Fluorescence Activated Cell Sorting [FACS]);
• Oxylad system for animal metabolism research;
• Liquid chromatography equipment with tandem masselective detector and the functioning of the nitrogen generator;
• The Biopharmacy centre part of the new LIOS building – 894.5m²;
Beneficiary – Latvian Biomedical Research and Study Centre:
- Multifunctional genome sequencing machinery;
- Automatized system for nucleic acid isolation;
- Bioanalyzer;
- Radioactivity meter;
- Robotized machinery for a large quantity, small volume reaction preparation and processing;
- Versatile application incubator-thermostat;
- A nucleofector;
- Ultra Centrifuge with a rotor set;
- Dynamic light dispersion spectrometer;
- Accessories for electron microscopy;
- High effectiveness gel chromatography equipment;
- Protein crystallography X-ray generator;
- Basic equipment for the animal block;
- Animal cage cleaning and sterilization system;
- Water purification equipment;
- Basic equipment for the cell laboratory;
- Cell sorting system;
- Florescence point analyser
- GMP (good manufacturing practice) block for cells;
- Reconstruction of the Biopharmacy centre’s buildings – 1700m²;

Beneficiary – University of Latvia:
- Reconstruction of BMC buildings - 738m²;
- Immunohistochemistry, histology equipment
- Equipment for quantitative sample analysis
- Laboratory animal behavioural recorder
- Equipment for measuring physiological and metabolic processes in people;
- Machinery for live cell research, visualization and functional characterization;
- Analytic equipment for biological sample components and metabolic characterization;
- Equipment for the real-time measurements of cell cultures’ toxicology, metabolism and differentiation potential analysis;
- Construction of a new building in Jelgavas street 1 (Land in possession) – 443.42m²;

Beneficiary - Riga technical university:
- Renovation of Riga Technical University premises – 35.1m²;

Main problems
According to the beneficiary’s representatives, it was a very lengthy and bureaucratic process.

Contact
Name, position: Dace Kārkle, Financial director of IOS
E-mail: dacck@osi.lv
SF FUNDED PROJECT 2

Project title: Contribution of human resources in the synthesis and studies of practical applications of new heterocyclic anticancer agents and diagnostic tools.

Project No: 2013/0002/1DP/1.1.1.2.0/13/APIA/VIAA/005
Beneficiary: Latvian Institute of Organic Synthesis
Type of institution: Public Research Organization

Budget
- EU contribution: €449 thousand
- National contribution: €49 thousand

SP funding instrument
- ESF Funding scheme: 1.1.1.2.0 Social Fund project Program “Human resources and employment.”

Time frame of the project: 2013 – 2015

Main project objectives
The project is committed to promoting new heterocyclic compound design with an outlook to their potential applications as new anti-cancer medicines and diagnostic tools and development of innovative synthetic methods and technologies. Design and studies of the substances which can form nanoaggregates to promote drug delivery processes into cells is also included. Under the umbrella of the project, it is planned stereoselective synthesis of leading compounds.

The project is directly aimed at improving human health, quality of life and increase in active economic life extension. Conversely, the use of nanotechnology related to innovative materials having a broad development and industrial level.

Specific goals (expected output)
The expected output of the project is research results disseminated in 5 publications.

Collaborative work within the project
The project partner is Latvian Biomedical Research and Study Centre.

Type of costs covered
Breakdown of the budget by type of costs covered

<table>
<thead>
<tr>
<th>Type</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>€359,000</td>
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<tr>
<td>Consumables</td>
<td>€50,000</td>
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<td>Travel</td>
<td>€10,000</td>
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<td>Overhead</td>
<td>€76,000</td>
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<tr>
<td>Other</td>
<td>€3,000</td>
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</tbody>
</table>

Main Results
- LIOS created a new interdisciplinary scientific group (Raised job placement equivalent to 7,213 in the field of science);
- The Scientific Council of LIOS has approved the research report (Annex of the Scientific Council’s hearing protocol);
- 20 new original compounds have been synthesized and characterized by a certificate form;
- An original biotechnological approach (know-how – a new methodology) has been developed for enantiopure 1.4-DHP acquirement, only three stages instead of the previous experience of four and even more stages. The technology, which is based on the principles...
of green chemistry, is more atom economic and has a shorter reaction path to the target compound - enantiopure 1.4-DHP derivative acquisition;

- Two reports have been prepared, namely on:
  - Compound impact on Ca\(^{2+}\) ion quantity, which has been tested on A7R5 cell lines (rat aorta smooth muscle) and H9C2 (rat embryonic cardiomyocytes) cell lines from ATCC cell collection;
  - The cytotoxic effects of the synthesized compounds. Compounds’ toxic effects were determined by the alternative in vitro method, using Balb/c 3T3 cells (mouse fetal fibroblasts) and calculated compound’s concentration at which 50% of the animals survived (LD\(_{50}\));

- Project members with reports of the research results (obtained during the framework of the project) have participated in numerous international conferences:
  - ISOS XVII - the 17\(^{th}\) International Symposium on Silicon Chemistry;
  - Balticum Organicum Syntheticum;
  - 55\(^{th}\) International Scientific Conference of Riga Technical University;
  - 4\(^{th}\) International Conference on Multifunctional, Hybrid and Nanomaterials

Number of international conference theses - 6;

- Scientific results of the project were published in five scientific articles in journals contained on the Web of Science, SCOPUS or ERIH databases: Australian Journal of Chemistry; Tetrahedron Letters; Chemistry - A European Journal;

- Quaternized compound nanoparticle research conducted together with the partner - Latvian Biomedical Research and Study Centre – using physical-chemical methods. Electron microscopy studies were conducted for 10 nanoaggregate samples, using the equipment of the Latvian Biomedical Research and Study Centre. The jointly obtained findings were finalized into 3 international conference theses;

The scientific results achieved during the duration of the project will be used as the basis for future applications.

**Contact**

**Name, position:** Aiva Plotniece, project manager

**E-mail:** aiva@osi.lv
FP FUNDED PROJECT 1

Project title: “InnovaBalt.”
Weblink: http://www.innovabalt.eu/
Beneficiary: Latvian Institute of Organic Synthesis
Type of institution: Public Research Organization

Budget
- Total cost: €5.26m
- EU contribution: €4.71m

SP funding instrument
- Funding scheme: CSA-SA - Support actions
- Subprogram: REGPOT-2012-2013-1 - Any research topic covered by the EU FP7
- Call for proposal: FP7-REGPOT-2012-2013-1

Time frame of the project: 2013-2017 (length 42 month)

Main project objectives
The general objectives of the InnovaBalt project are to improve multidisciplinary research capacities and strengthen the management of intellectual property and human resources for innovative drug discovery at the Latvian Institute of Organic Synthesis (IOS).

Partners within the project
1. Centre de RMN à Très Hauts Champs, Ecole Normale Supérieure de Lyon, France
2. Institute of Biotechnology, Vilnius University, Lithuania
3. The Antwerp Drug Discovery Network (ADDN), University of Antwerp, Belgium
4. RWTH Aachen University, Germany
5. Uppsala University, Sweden
6. Aalto University, Helsinki, Finland
7. University of Florence, Italy
8. Leiden University, the Netherlands
9. Eurice Ltd
10. University of Zurich
11. Tartu University, Estonia

Training and networking organizations
1. Bruker, UK
2. CR54 - Centre for Advanced Studies, Italy
3. Delft University of Technology, The Netherlands
4. Ecole Polytechnique Fédérale de Lausanne, Switzerland
5. F. Hoffmann-La Roche Ltd, Switzerland
6. Helmholtz Zentrum München (Technische Universität München), Germany
7. Inhibox, UK
8. Innsbruck Medical University, Austria
9. Institut de Ciència de Materials de Barcelona, Spain
10. Istituto di Biostrutture e Bioimmagini-CNR, Italy
11. Jagellonian University, Poland
12. Loughborough University, UK
13. Max-Planck-Institut für Kohlenforschung, Germany
14. Palacký University Olomouc, Czech Republic
15. Parma University, Italy
16. Perugia University, Italy
17. Rudjer Boskovic Institute, Croatia
18. RWTH Aachen University, Germany
Specific objectives
The scope of the project foresees the implementation of the following objectives:

1. Long-lasting scientific collaboration and strategic partnerships between IOS and 50 outstanding research institutions will be established and sustained to increase the visibility of IOS in the European Research Area (ERA);
2. The management of intellectual property will be improved, and innovation will be increased by collaborating with and attracting 14 external professionals;
3. The research infrastructure and qualification of human resources at IOS will be upgraded in the fields of modern process chemistry, green chemistry, biophysical chemistry, in silico drug discovery, advanced forms for drug delivery and research and innovation management to promote the capacity for high-level research on innovative drug development;
4. The synergy between research on innovative drug development and end-users will be ensured to meet the socio-economic needs of the Baltic region.

The implementation of the objectives above will reinforce the strategic development of IOS, improve the scientific outcomes and promote the long-term impact of the IOS research through its wholesome integration into the ERA.

Type of costs covered
Breakdown of the budget by type of costs covered

<table>
<thead>
<tr>
<th>Type</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Subcontracting</td>
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<td>Other</td>
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<td>Total</td>
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</tbody>
</table>

Contact
Name, position: Ivars Kalvinsh, Coordinator
E-mail: kalvins@osi.lv
FP FUNDED PROJECT 2

Project title: “CheTherDel.”
Beneficiary: Latvian Institute of Organic Synthesis
Type of institution: Public Research Organization

Budget
- Total cost: €120 thousand. (IOS share of the project)
- National contribution: €120 thousand.

SP funding instrument
- Funding scheme: FP7 (though ERA-NET)
- Subprogram: ERA-NET EuroNanoMed (European Network of Transnational Collaborative RTD Projects in the Field of Nanomedicine)
- Call for proposal: 3rd Joint Call – 2011

Main project objectives
Liver metastasis can be targeted with a variety of non-curative therapeutic methods. The aim of this Project is to control the malignant disease as a chronically manageable problem; to target the malignant tissue in a selective way using thermal modification of tissue with focal microwaves that will expose new antigens in the liver structures. Another aim of the Project is to target these tissues with functional nanoaggregates loaded with magnetic particles, which are intended for long-term tissue fixation. These particles can produce local heat by external activation, accompanied by local delivery of chemotherapy, using the instability of liposome’s loaded with specific chemotherapeutic agents. Using this methodology repeatedly, it might be possible to induce a highly effective combination of hyperthermia and chemotherapy in a localized area and to minimize the systemic effect, for an effective control of liver tumors. Collaborative work within the project.

The project partners are:
- The Coordinator of the project: Mihail-Gabriel Dimofte
- University of Medicine and Pharmacy „Gr.T.Popa” Iasi, Romania
- Emergency Hospital ”Sf. Spiridon”, Jasi (Romania)
- ”Gheorghe Asachi” Technical University of Iasi (Romania)
- University of Padova (Italy)
- Latvian Institute of Organic Synthesis, Riga (Latvia)
- University of Franche-Comte, Besancon (France)

Type of costs covered
Breakdown of the budget by type of costs covered

<table>
<thead>
<tr>
<th>Type</th>
<th>Amount</th>
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<td>Consumables</td>
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<td>Overhead</td>
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<td><strong>Total</strong></td>
<td><strong>€120,000</strong></td>
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Main Results
Main project outputs include 3 publications and 3 conference thesis (referenced below).

Publications:


Conference theses:


Contact
Name, position: Aiva Plotniece, project manager
E-mail: aiva@osi.lv

13 Available at: http://dx.doi.org/10.1016/j.crci.2013.07.003