



Nanotwinning Report Summary

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Final Report Summary - NANOTWINNING (Increase in opportunities for strategic collaboration in the field of nanotechnology via twinning of IOP with institutions of European Research Area)

Executive Summary:

Activities of the Nanotwinning Project were focused on stimulation of cooperation between Ukrainian scientists and European representatives of science, education and business. The project was aimed at sustainable development of nanotechnologies in the Institute of Physics of the National Academy of Sciences of Ukraine (IOP), at stimulating innovative activities of IOP through establishing of contacts between Ukrainian and European scientists, technological innovators and business structures for technology transfer implementation and growing investments into the science. It helped:

- to stimulate development of nanotechnologies through creation of joined International laboratory "Surface enhanced spectroscopy" (SES) and through holding the International conference "Nanotechnology and Nanomaterials" (NANO) in 2013 and 2014;
- to adopt European practice on creation, expertise and transfer of nanotechnology in Ukraine through participation in the nanoscience conferences in order to familiarize with the advanced developments and technologies in nanoscience;
- to maintain a flexible and adequate portfolio of R&D activities through the participation in international trade fairs;
- to establish strategic alliances with R&D institutes and universities at the national and international level to increase Institute's scientific capacity International SES laboratory was created on cluster principle;
- to involve young scientists in the priority areas of science both from the IOP and the partner institutions. To achieve this goal three International Summer Schools were held and grants for young scientists were provided;
- to improve scientific staff competences in preparation and application for grants under FP7 and H2020 Programmes. Special trainings on participation in Seventh Framework and Horizon Programme 2020 were made;
- to enhance significantly the level of cooperation with industry and businesses in the area of intellectual property commercialization. Two International Technology Meetings were organized in Kyiv, Ukraine;
- to improve the IOP's strategic management system through adoption of the Project Partners' good practices. For this task visits of Director of IOP to the partners' institutes were made in 2015 and strategic plan for IOP was developed;
- to increase strategic cooperation between Ukrainian scientists and European representatives of science, education and business. A range of proposals were developed and submitted jointly with the project's partners and other experienced EU experts in the course of the project implementation, a few were highly evaluated and supported;
- to disseminate information and to share experience gained in the course of the Nanotwinning Project.

Information about the Project, as well as experience gained was disseminated at International conferences NANO and international summer schools for young scientists organized with involvement of mass media, publication of books and joint articles: proceedings of each summer school and NANO conference were published by Springer publishing house; scientific articles which were presented at NANO conferences were publishing as special issue of open access journal "Nanoscale Research Letters"; abstract books for each NANO conference and Schools were also published.

Project Context and Objectives:

The Nanotwinning Project was aimed at one of FP7 Thematic priorities - Nanosciences, Nanotechnologies, Materials & new Production Technologies. The project provided a number of events, which were focused on increasing opportunities for collaboration in the field of nanotechnology via twinning of Institute of Physics of the National Academy of Sciences of Ukraine (IOP) with institutions of ERA. The IOP is the coordinator of the Project. European partners of Nanotwinning Project are: Pierre and Marie Curie University (France), the University of Turin (Italy), the University of Tartu (Estonia) - well recognized in the world in the field of nanotechnology, and European Profiles (Greece) which role was to assist in creation of strategic plan of development of the IOP and to foster the participation of scientists of the Partner institutions in FP7 and Horizon 2020 Programmes. There were 5 Work packages (WPs) provided in the Nanotwinning Project: the 1st WP was aimed at general coordination, achievement of all project milestones and implementation of the Project. The 2nd WP was focused on integration of scientists of IOP in ERA by experience exchange, creation of joined International "Surface enhanced Spectroscopy" (SES) Laboratory and organization of International research and practice conference (NANO). The 3rd WP provided involvement of youth into promising directions of research by open days in the Institute; short-term grants for trainings, travel grants for participation in conferences and organization of international summer schools. The 4th WP was dedicated to the search of ways of additional funding attraction into science and innovations - workshops and technological meetings were held, where not only representatives of science

and external experts, but also representatives of business were involved. On the last stage (WP5) the system of strategic management of IOP was analyzed and improved by creation of plan of the Institute sustainability for the next 5 years.

The project consisted of a number of events focused on stimulation of cooperation between Ukrainian scientists and European representatives of science, education and business in two basic ways:

1) Strengthening of scientific collaboration.

2) Enhancement of high-tech cooperation.

Revival of old ties, deepening of existing ones and creation of new relationships with European institutes and business representatives allowed to improve the strategic management system of IOP based on the new Sustainability Policy - 5-years Action Plan (5Y-AP). The activities of the project were elaborated to resemble the work of a spider, which was weaving a net of scientific and commercial ties between Ukraine and Europe for the project concept implementation. The mission of the project was increase of opportunities for collaboration in the field of nanotechnology via twining of IOP with institutions of European Research Area in order to help the Institute to:

- adopt the good practices of the leading EU R&D centers to improve the strategic management system of the IOP;
- adopt European practice on creation, expertise and transfer of nanotechnology for Ukraine;
- stimulate development of nanotechnologies as a priority development area for ensuring Institute's regional leadership;
- maintain a flexible and adequate portfolio of R&D activities;
- improve scientific staff competences in preparation and application for grants under FP7 and H2020;
- enhance significantly the level of cooperation with industry and businesses in the area of intellectual property commercialization;
- establish strategic alliances with R&D institutes and universities at the national and international level to increase Institute's scientific capacity;
- involve young scientists in the priority areas of science both from the IOP and the partner institutions;
- disseminate information and share experience gained in the course of the Nanotwinning Project.

Project Results:

Main S & T results/foregrounds of WP2

WP 2. Objectives: Enhancing cooperation with European research centers in the field of nanotechnology for exchanging knowledge and good practices, disseminating scientific information, identifying partners and new opportunities and directions in field of nanotechnology, setting up joint experiments through the creation of an international laboratory "Surface enhanced spectroscopy". Results:

International laboratory SES was created in 2012. This laboratory is established on a cluster principle and includes scientific groups from four Partners: IOP, IPUT, UPMC and UNITO. The laboratory develops and stimulates investigation of different effects (Surface enhanced infrared absorption, Surface enhanced Raman scattering, Metal Enhanced Fluorescence etc). A range of joint experiments were set up at the SES laboratory during the short-term visits of the main nanotechnology specialists involved in the Project to each other in the course of the Project's implementation. This activity was performed by means of using powerful spectroscopic equipment situating in the laboratories of EU Project participants and equipment set up in International SES Laboratory at Institute of Physics NASU. The SES laboratory mission is "from knowledge creation to technology transfer". Activities of this laboratory consolidate old contacts and create new relations with other scientific groups in the world working in similar directions.

Renishaw inVia Raman spectrometer purchased within the framework of Nanotwinning project is installed in the Laboratory as well as other equipment of IOP available for use by Partners within the activities of Lab.

SES Laboratory website address is the following: <http://www.iop.kiev.ua/~nanotwinning/seslab/>. It contains information about the Laboratory's mission, goals, history, people, equipment etc. Also 3D tour around SES Laboratory is available. Each Partner participated actively in scientific cooperation within the activities of SES laboratory. In particular, branches of the SES laboratory were established in University of Turin (Italy), Pierre and Marie Curie University and Institute of Physics of University of Tartu.

Partner institutions shared their knowledge and good practices in Raman spectroscopy and set up a range of joint experiments. The joint experiments of SES laboratory were done during the short-term visits of the main nanotechnology specialists involved in the Project to each other. This activity was performed with the use of powerful spectroscopic equipment situating in the laboratories of EU Project participants and equipment set up in International SES Laboratory at IOP.

International research and practice conferences "Nanotechnology and nanomaterials" NANO2013 and NANO2014 were held in Bukovel and Lviv, Ukraine in 2013 and 2014. This conferences were held as large-scale international events, first three days of which were organized in the format of International summer school for young scientists "NANOTECHNOLOGY: from fundamental research to innovations" and next 4 days were continued in the format of International research and practice conferences NANO2013 and NANO2014. The conferences focused on the latest advances in nanoscience and nanotechnologies and promoted profound scientific discussions between scientists and researchers from different disciplines and more than 16 countries. Conferences gathered about 500 scientists working in the field of nanotechnology and nanomaterials, also in the fields that are on sidelines of scientific directions, among them many representatives of leading research institutes and higher educational establishments of Ukraine and Europe.

WP3 Objectives: to involve youth in perspective directions of nanoscience and help to develop independent careers and make the transition from working under a supervisor to being independent researchers in their own right

Results:

Science Festivals were successfully held in 2012 and 2013. Ukrainian students from different physical, technical and mathematical lyceums, schools, gymnasiums, universities of Ukraine attended lectures that were presented in conference hall of the Institute of Physics of NAS of Ukraine. Lectures were delivered by scientists of the Institute and by young scientists of Nanotwinning project Partners: representatives of the University of Tartu (Estonia) and Pierre and Marie Curie University (France) in 2012 and of University of Turin (Italy) and the University of Tartu in 2013. Also there were organized excursions for students in the laboratories of IOP to cryogenic laboratory, laboratory of laser spectroscopy, femtosecond laser center, department of coherent and quantum optics etc. In total the Institute of Physics within the Science Festivals received about 450 students in 2012 and about 400 students in 2013.

Within this WP competitive granting of 12 young researchers by short-term scientific visits (1 week) for training and exchange of good practices in nanotechnology were planned. IN the course of implementation of Nanotwinning Project the following short-term scientific visits were held:

1. Graduate student of the Department of Crystal of Physics of IOP, Serhii Tomylo took training in laser spectroscopy laboratory of the Institute of Physics of the University of Tartu, Estonia (16-23 February 2013). Training was aimed at detection of powders units of nanoparticles (carbon nanotubes, laponit), nanoparticles in liquid crystals and distilled water.
2. Young scientist Vitaliy Boyko of Department of Biological Systems of IOP took training at Institute of Physics, University of Tartu in the Laboratory of laser spectroscopy from January 26 to February 2, 2013. Thematic area of his training focused on measurements of fluorescence life time for synthetic opals and solutions of organic molecules in the nano- and microsecond regions, detection of luminescence of synthetic opals before and after infiltration of biological molecules in their pores etc.
3. Post doc fellows Federico Catalano and Gabriele Alberto of Department of chemistry, University of Turin took training in SEIRA and SERS spectroscopies from June 30 to July 6 2013 in Institute of Physics at International Surface Enhanced Spectroscopy Laboratory, Institute of Physics, NAS Ukraine.
4. Researcher Oleksandr Kurochkin of Crystal Physics Department of IOP received a grant for short-term training at Institute of Nanosciences of Pierre-and-Marie-Curie University, Paris, France. The training was held at the Group of Physical Chemistry of functional surfaces from 20 to 26 May, 2013. During the short-term training under direction of Dr. Emmanuelle Lacaze, the formation of linear assemblies of ferroelectric nanoparticles of two types was studied.
5. On October 2013 young scientist PhD Anton Senenko from IOP received a grant for short-term visit to Paris Institute of Nanosciences of Pierre and Marie Curie University to set up experiments concerning investigation of ultrathin organic films adsorbed on atomic smooth surfaces under the leadership of Prof. Emmanuelle Lacaze. Since the experiment required more than a week for its completion, it was decided to award PhD Senenko with two grants.
6. Young scientist PhD Pavlo Ivanchenko from Turin University on 18.08.2014-30.08.2014 visited the Department of Physics of Biological Systems of IOP and investigated an applicability of Hydroxyapatite, TiO₂, and Silica nanoparticles for obtaining of Surface Enhancement of Infrared Absorption (SEIRA) effect.
7. Young scientist of the Technology Transfer Department of IOP PhD Vladyslav Kavelin received a grant for short-term visit to University of Turin, Italy on March 22-27 2015. Spectra of molybdenum sulfide, graphene, thymine and gold nanoparticles were measured using Raman spectroscopy and infrared spectroscopy methods with the help of Dr. Alessandro Damini from University of Turin.

Young researches received grants to participate in the international nanoscience and nanotechnological conferences within this WP. Young scientist of Coherent and Quantum Optics Department of IOP PhD Lyudmyla Kokhtych participated in the 30 International school of atomic and molecular spectroscopy "Nano-structures for optics and photonics", that took place at the "Ettore Majorana Foundation and Center for Scientific Culture". The School was held on July 4-19, 2013 in Erice, Italy.

Young scientist of the Department of Physics of Biological Systems of IOP PhD Vitalii Boiko attended the 9th International Conference Functional Materials and Nanotechnologies «RCBJSF-2014-FM&NT», that took place from 29 September to 2 October 2014 in Riga, Latvia. The conference was devoted to materials science as a technology forming a bridge between basic science and applied engineering.

At the conference Vitalii Boiko made an oral report on the topic «New materials for nanobiophotonics based on photonic crystals». This report received rave reviews and suggestions for further improvement of the proposed methods and study of the physical principles underlying the experimental data. Within this task of the Nanotwinning Project the following young scientists of the Project Partners' institutions contributed to the 1st, 2nd and 3rd International Summer Schools "Nanotechnology: from fundamental research to innovations" held in Bukovel, Ukraine in 2012, 2013 and 2014: PhD Gabriele Alberto (University of Turin), PhD Valentina Aina (University of Turin), PhD Loot A. (University of Tartu), PhD Repan T. (University of Tartu), PhD Kopanchuk S. (University of Tartu), PhD Pelliser L. (Pierre and Marie Curie University), PhD Sleczkowski P. (Pierre and Marie Curie University), PhD Caillard M.L. (Pierre and Marie Curie University), PhD Sara Cravanzola (University of Turin), PhD Siim Heinsalu (University of Tartu), PhD Pavlo Ivanchenko (University of Turin), PhD Claudio Magistris (University of Turin), PhD Iryna Gryn (Pierre and Marie Curie University).

International summer schools "Nanotechnology: from fundamental research to innovations" in 2012, 2013 and 2014 in Ukraine for young researchers were organized. Participation in the summer schools opened the opportunity for young scientists to listen to a series of lectures on the fields of Nanosciences & Nanotechnologies. Scientists of worldwide reputation from universities and research centres from Ukraine and Europe shared their knowledge and experience. In addition to scientific lectures young scientists also listened to a cycle of introductory lectures on the Seventh Framework Programme and Horizon 2020. The concept of the school was to combine learning, scientific experience exchanging and recreation, therefore the schools were held in the Carpathians in order young scientists spent a week in a confined space and could communicate with each other.

WP4 Objectives: To stimulate and support innovations, to encourage attraction of investments by overcoming a gap between scientific research and production, to develop effective system of technology transfer in IOP adopting best practices from European institutes and universities.

Results:

This WP helped to move IOP to delineate areas where research and development are needed to provide new technologies and innovative practice. The existing worldwide partnerships with research community were extended to identify potential breakthrough areas. This WP provides for 4 tasks: exchange of good practice; creation of new contacts in the field of TT; holding of International technology meetings; and Workshop "Applied use of surface enhanced and laser spectroscopy".

Within this WP the following events took place:

Trainings of the staff of Technology transfer department of IOP in the institutes and universities of Partners and other EU establishments.

Manager and Expert of Nanotwinning Project took part in the Meeting of the Article 21.5 Partners of the Enterprise Europe Network (EEN) on 2-5 July 2012 in Brussels. They established there new contacts with scientists and innovation managers from Europe, Asia, USA etc, received new skills in stimulation and support of innovations, attraction of investments and development of effective system of technology transfer, listened to a series of lectures and trainings devoted to FP7 and its successor Horizon 2020. Also they discussed experience of participation in FP7 and opportunities for future collaboration within FP7 with representatives of different countries, including countries participating in the European Neighbourhood Policy.

From 31 October till 2 November Manager and two Experts of Nanotwinning Project made a visit to Latvian Technological Centre where they attended several trainings within activities of Enterprise European Network. Representatives of Latvian Technology Centre shared their experience on participation in FP5/FP6/FP7 projects, as well as on technology transfer, partnership establishment with high-tech enterprises, industrial associations and scientific institutions. In addition to trainings there were organized several meetings with Latvian institutes and associations, among them meeting with scientists of Latvian Institute of Atomic Physics and Spectroscopy. Visit to aforementioned Institute was very useful from point of view of international scientific collaboration between Ukrainian and Latvian scientists. It was decided to consider the possibilities for joint participation in FP7 and other European Programmes since Latvian Institute of Atomic Physics and Spectroscopy conducts a range of researches that have common points with research directions of the Institute of Physics of NAS of Ukraine.

The staff of Technology Transfer Department of IOP participated in specialized online training "Commercialization Pathfinder" of CRDF Global. The course was based on the technology entrepreneurship development curriculum developed by a team of professors from the MIT Sloan School of Management and CRDF Global. In the second period of the Nanotwinning Project implementation staff of TT Department of IOP also participated in a range of local, national and international conferences, such as: VI International research and practice conference "The role and importance of intellectual property in innovative economy" (11-13 November, 2014, Intellectual Property Institute of "Odesa Law Academy" National University, Kyiv, Ukraine), International meeting on Europe Enterprise Network (15-18 October, 2014, Turin, Italy).

In order to create new contacts in the field of TT IOP participated in International trade fair "Laser World of Photonics" in Munich which resulted in cooperation agreement signed with German and Israel companies interested in joint production of laser energy meters. Under this agreement an initial batch of energy meters was purchased by these international companies. During the exhibition stand of IOP was visited by more than 70 representatives of various companies and R&D centers, including Kvant, Newport Corporation, Ophir, Coherent and others. Also Nobel Laureate in Physics Theodor W. Hansch visited the booth. The IOP was the only organization from Ukraine, which participated in this event and exhibited its innovative products, that was the reason for raising of the Ukrainian flag together with other countries - exhibitors.

On 26 February 2015 the workshop on Enterprise Europe Network was held within the frame of IncoNet EaP Project. Dr. Olena Fesenko moderated a special session at the workshop dedicated to EEN, COSME and Horizon 2020 Programs and delivered the talk "European Programs: goals, challenges and opportunities for Ukrainian innovative enterprises and research organizations". In general 55 representatives from Armenia, Azerbaijan, Belarus, Georgia, Moldova, Ukraine and Poland participated in the Workshop.

To enhance cooperation between Ukrainian and European scientists and to study the experience of technology transfer and strengthening of connections between science and industry in the field of nanotechnology the International Technology Meetings were held in 2012 and 2013. At these international events scientists of different institutes of National Academy of Sciences presented their developments created in sphere of nanotechnology. These International Technology Meetings were organized with aim to bring together representatives of scientific and business spheres. The goal was to assist in commercialization and introduction of scientific and technical results and to strengthen scientific ties with representatives of the industrial sector (especially for small and medium enterprises, SMEs) and business organizations and also to bring these scientific and technical results to the market. The main objective of the event was to create a meeting forum for companies, research institutes, universities and other organizations which are actively engaged within the of nanotechnology and bio-chemical technologies. The Technology Meeting was streamed online. Broadcast was financed from the budget of Nanotwinning Project and it was visited by about 500 peoples from such countries as Russia, Belarus, Estonia, Poland, France, Great Britain, Czech Republic, Germany, Italy, Japan, Netherlands, Belgium, United States and others.

The International Workshop "Applied use of surface enhanced spectroscopy" was held from 8 to 10 March 2014 in the Institute of Physics of Tartu University (Tartu, Estonia). More than 30 scientists from different countries (France, Italy, Estonia, Austria, Germany, Poland, Ukraine etc) made reports and presented their research results in the field of surface enhanced spectroscopy. The main purpose of this event was consolidation and exchange of experience between research groups involved in the IR, Raman and laser spectroscopy. During the workshop there were discussed the most promising ideas and possible applications of different nanostructures. Scientists participating in this workshop had a profound knowledge in the field and during this workshop they shared their good practice with other participants.

The form of round table allowed involvement into the discussion of well known international experts, who gave their expert estimations of certain experimental and theoretical approaches, disseminated information about realization of the Nanotwinning project and sized up impact of the project results on the European scientific community and interested technological companies.

WP5 Objectives: to improve the IOP strategic management system based on the new Sustainability Policy (5Y-AP) and the experience and knowledge obtained during this project.

Results:

Since WP5 of the Nanotwinning Project focused at improvement of the IOP strategic management system, visits of IOP Director to the partners' institutes (Pierre and Marie Curie Actions University (UPMC), University of Turin (UNITO), Tartu University (IPUT)) were made on March 23-27 2015 in order to meet with Administrations of Partner institutions to exchange good practices concerning strategic planning and their participation in FP7 and Horizon 2020. Director of IOP, Professor Leonid Yatsenko had meetings with the Pro-rector for Research of the University of Turin, Professor Marcello Baricco, Dr. Claudia Barale from the Common Strategic Task Force (CSTF) of the University of Turin, Ms. Elena Billi-Rizza, Head of Office of Research and Technology Transfer of UPMC, Director for research of INSP, Prof. Christophe Testelin, Prof. Emmanuelle Lacaze and Ass. Prof. O. Pluchery of UPMC, Director of Institute of Physics of Tartu University, Prof. Jaak Kikas and Head of the Laboratory of IPUT Dr. Ilmo Sildos and others. At these meetings the European practices in the field of strategic management of R&D centres were discussed and reviewed in order to adapt them to the Ukrainian modern context. After these meetings European practices and principles for preparing of strategy plan for the research organization were revised and analysis of IOP's institutional and scientific background Strategic Plan of IOP was made. The IOP Strategic Plan is only a tool for further efforts of the IOP management and staff to improve the IOP strategic management system, and most important, to achieve the institutional strategic goals and objectives. The implementation plan will be further elaborated in order to be directive, clear, and documented and this activity will be continued after the Nanotwinning Project completion. According to the IOP Strategic Plan it was decided to enhance visibility of IOP at local, national and international levels. In this regard there was developed a new modern website containing information about its mission, vision, goals; research priorities and current investigations and achievements; open projects and possibilities that it provides to young scientists; cooperation offers for other research institutes/universities and industry both local and from abroad. Also the brochure in English containing information about Institute, its main scientific directions and developments was developed.

WP5 was also aimed at identification of working groups of scientists able to take part in FP7 and Horizon 2020. They were recognized inside the consortium within the IOP staff and the staff of the Partners institutes. Main priority research directions and leading scientists that are conducting them were defined. Within implementation of this task scientific contacts between leading IOP scientists and scientific groups of Partners were also established. These groups possess innovative scientific approaches and are ready for participation in different programmes, such as Horizon 2020 and others. Identified working groups are not only scientific but also include specialists on marketing analysis and technology transfer.

List of groups identified: From IOP

- Group of Dr. Marchenko;
- Group of Prof. Ivan Blonskyi;
- Group of Prof. Yuri Reznikov;
- Group of Prof. Galina Dovbeshko;
- Group of Dr. Tetiana Smirnova;
- Technology transfer, innovations and intellectual property department (TT Department);

Groups of partner institutions

- Group of Prof. Gianmario Martra at Interdepartmental Centre "Nanostructured Interfaces and Surfaces (NIS)", Italy;
- Group of Dr. Leonid Dolgov at the Laboratory of laser spectroscopy of the Institute of Physics, University of Tartu;
- Group of Prof. Emmanuelle Lacaze at Pierre and Marie Curie University, France.

These above mentioned scientific groups have already established successful cooperation and submitted and developed a range of international project proposals within such programs as:

- Tempus IV Sixth Call for Proposals (EACEA/35/2012);
- FP7-INCO-2013-9 R2IENP;
- FP7-PEOPLE-2013-IRSES - ILSES Project;
- FP7 Marie Curie IRSES - FAEmCar project.
- FP7-INFRASTRUCTURES-2013-2;
- H2020-CBTT-2014, Capacity-Building in Technology Transfer;
- H2020-FETOPEN-2014-2015-RIA, FET-OPEN - Novel ideas for radically new technologies - Research Projects;
- FP7-ICT-2013-X (FET Open Xtrack) etc.

Proposals submitted within the frame of FP7-PEOPLE-2013-IRSES and NATO program "Science for Peace" have been highly evaluated, supported and are being successfully implemented now.

All targets of the Nanotwinning Project were achieved and all results obtained.

Potential Impact:

Within the Nanotwinning Project three Summer Schools were successfully held. They promoted science in Ukraine and assisted to career growth of young scientists, which established new contact at the schools, exchanged with good practices and shared their achievements in nanoscience.

International conference NANO gathered famous scientists of the world as well as young researchers in 2013 and 2014. It has influenced on development of Ukrainian and world nanoscience and therefore the NANO conference will be continued after the Nanotwinning Project's completion.

It is planned that International SES Laboratory created in the course of the Nanotwinning Project implementation will continue its research activities after the Project's completion and will be strengthened by new scientific groups from leading world institutions specializing in nanotechnology.

Knowledge gained in the course of development of 5 Years-Action Plan for IOP as well as good practices concerning strategic planning; international cooperation and knowledge transfer will positively influence on IOP strategy and development. Adopted good practices of the Project Partners will help IOP to increase the number of young scientists involved in international programs and local grants for scholarship.

Objective and results of the Nanotwinning project correspond closely with innovative nature of the strategy of EU education and science development. This project besides enhancing science and technology cooperation between scientists of IOP and the European Research area aimed at support of young scientists both in Ukraine and in Europe by means of Science Festivals, issuance of short-term grants for training and exchange of good practices in nanotechnology, issuance of travel grants for participation in international conferences. Grants for young scientists provided within the implementation of the Project had huge influence on their scientific career and assisted in exchange of their scientific achievements abroad. Now there is proclaimed in EU the principle of increase of investments into human resources so far as it exactly became to be regarded as the main instrument for development of knowledge society. The WP3 of the Project provided support for young scientists that could be regarded as investments into young cadres, consequently, in stable future.

The Nanotwinning project also corresponded clear with EU strategic objective - "Openness of EU knowledge to the whole world" that provides for:

- strengthening of relations between production and scientific research and society on the whole;
- development of entrepreneurship spirit;
- intensification of foreign languages study;
- enhancement of mobility and exchange;
- strengthening of European cooperation.

Nanotwinning project in its WP4 aimed at innovative cooperation and knowledge transfer in consequence of strengthening of relations between production and scientific research both in Ukraine and in Europe. Since Nanotwinning project was aimed at enhancing of cooperation in the field of nanotechnology, it contributed to the solution of another significant EU task - growing of those who are specializing on technical and natural fields of science. In general Nanotwinning project corresponded closely with EU concept aimed at intensification of European Research area openness for continuous development that provides for openness for new ideas (resulting both from involvement of ideas and spreading of own ones), relations with the world of economics and business and for satisfaction of real needs of citizens.

Nanotechnologies can be considered as a huge cluster in which big variety of modern scientific areas are combined. Confinement into the separated country or particular branch of science limits the development of nanotechnologies. In order to avoid such limitations Nanotwinning was developed and implemented. Nanotwinning project focused on the reinforcing cooperation between IOP and European Research area exactly in the field of nanotechnologies. Project Partners from different countries of EU have versatile experience in nanotechnologies. Such choice of partners was made in accordance with the concept of creation of scientific and commercial contacts network between the European scientists and IOP. During implementation of the Nanotwinning Project its consortium considered the vital priorities of FP7, such as scientific investigations and innovations, which directly met the requirements of European industry. Horizon 2020 has similar priorities which focus on scientific research and innovation directly relevant to the needs of European industry with a view to enhance international European competitiveness, and also to society to improve quality of life. Therefore one can consider nanotechnologies as a symbiosis of science and business. It is important to note that Nanotwinning project was focused not only on the scientific cooperation, but also on the transfer of knowledge by overcoming the gaps between the scientific investigations and industry on the national and international levels. This project was intended for researchers, institutions and mass media working together in transnational consortia. Marketing analysis of some selected nanotechnologies was made and presented at international trade fair, where potential consumers and investors were revealed, resulting in cooperation agreement with two international companies from Germany and Israel.

During implementation the Nanotwinning Project two special technological broker meetings directed on the transfer of knowledge. Technologies from IOP and other institutes of NASU (more than 30) were presented on these international technology meetings. This project helped in development of innovations and transfer of knowledge not only for IOP, but also for other institutions of NASU. Variety of technologies stimulated interest of potential investors and enhanced probabilities for successful transfer of knowledge. Researchers and representatives from different companies created new work groups and prepared joint competitive projects in frame of FP7, H2020 and other international programs. IOP as a coordinator of business-portal "Nanotechnologies and nanomaterials" informed target groups of researchers, engineers, businessmen and interested people about the meeting. Video presentations of technologies presented at these meetings are available on this business-portal <http://www1.nas.gov.ua/programs/nano2b/EN/Pages/VTM2.aspx>. Future development of this portal is directed to the transformation in the technological broker internet space, which will consolidate researchers, businessmen, financial institutions and manufacturers.

Main dissemination activities:

Main channel for information dissemination of the Nanotwinning Project and its events, such as summer schools, conferences, technology meetings etc was its website, as well as websites of conferences and schools:

Nanotwinning Project Website: <http://www.iop.kiev.ua/~nanotwinning/>
NANO2014 Conference website: www.iop.kiev.ua/~nanotwinning/conference2/
International Summer School website: www.iop.kiev.ua/~nanotwinning/iss3/
International SES Laboratory website: www.iop.kiev.ua/~nanotwinning/seslab/
New modern website of the Institute developed in the frame of the Nanotwinning Project will promote the IOP in Ukraine and physics in general in Ukraine, to enhance visibility of IOP at local, national and international levels. Also for this purpose the brochure in English containing information about Institute, its main scientific directions and developments was developed.

The special issue was published by Nanoscale Research Letters Springer Journal in 2014 which included articles based on talks delivered at the International research and practice conference Nanotechnology and Nanomaterials (NANO-2013) held in Bukovel, Ukraine, 29 August to 1 September 2013.

In 2015 Nanotechnology and Nanomaterials (NANO-2014) thematic series were published by Nanoscale Research Letters Springer Journal which included articles based on talks delivered at the 2nd International research and practice conference Nanotechnology and Nanomaterials (NANO-2014) held in Lviv, Ukraine, 27-30 August 2014.

YouTube Channel of the Nanotwinning Project www.youtube.com/user/Nanotwinning was created which contains records of the NANO Conferences, Summer Schools and Technology Meetings organized within the frame of the Project's activities. These records are also available on websites of Summer Schools and NANO Conferences; they are aimed to provide young scientists and every interested individual with an opportunity to learn the discussed at these events scientific topics, so the records can be used for e-learning.

All outcomes of the Nanotwinning Project and future plans of the Project were shared with the audience of the NANO International research and practice conferences. Nanotwinning Project Coordinator Prof. Leonid Yatsenko and Nanotwinning Project Manager Dr. Olena Fesenko were also interviewed by journalists of National TV Channels informing about the main achievements and results of the Project, also outlined the main future plans of the Nanotwinning Project partners after the end of the Project.

Ukrainian TV channels prepared a range of programs dedicated to each Summer School and NANO Conference. The main aim of the programs was to disseminate information on Nanotwinning Project, to promote science and to attract young researchers to nanoscience. Records of the programs are available on the Project website:

- Video clip about 1-st International Summer School at Intellect UA TV program - <https://docs.google.com/file/d/0Bxqva1PQ8AWoSHI1ZnJBRGjDS0U/>
- Video clip about 1-st International Summer School at Window to Europe TV program - <https://docs.google.com/file/d/0Bxqva1PQ8AWoNWUwc3VBSkNtVG8/>
- Video clip - announcement about Technology Meeting at the Windows to Europe TV program - <https://docs.google.com/file/d/0Bxqva1PQ8AWoTUICb1ZpTjIoodA/> -
- Video clip about Technology Meeting in the Windows to Europe TV program - <https://docs.google.com/file/d/0Bxqva1PQ8AWodjQxZ29HWVQtZ0E/>
- Video clip about 2-nd International Summer School and International Conference NANO-2013 at Window to Europe TV program of the 5th National Channel - <https://docs.google.com/file/d/0Bxqva1PQ8AWoNFpLZ1VKOFkxY3M/>
- Video clip about 2-nd International Summer School and International Conference NANO-2013 at Today TV program of TVi Channel - <https://docs.google.com/file/d/0Bxqva1PQ8AWoOTFRNFVCVzdyYzA/>
- Video presentations of technologies presented at technology meetings
<http://www1.nas.gov.ua/programs/nano2b/EN/Pages/VTM2.aspx> .

Successful implementation of the Nanotwinning Project resulted in enhanced cooperation in the field of nanotechnology between scientists of IOP of Ukraine and the European Research Area; intensified exchange and transfer of knowledge between IOP and European institutions, which encouraged the participation of scientists in H2020 and other international programs, promoting thorough integration of IOP into the European Research area.

List of Websites:

Information about the Project, as well as experience gained was disseminated at International conferences NANO and international summer schools for young scientists organized with involvement of mass media, publication of books and joint articles: proceedings of each summer school and NANO conference were published by Springer publishing house; scientific articles which were presented at NANO conferences were publishing as special issue of open access Journal "Nanoscale Research Letters"; abstract books for each NANO conference and Schools were also published.

List of websites:

Nanotwinning Project Website: <http://www.iop.kiev.ua/~nanotwinning/>
NANO2014 Conference website: www.iop.kiev.ua/~nanotwinning/conference2/
International Summer School website: www.iop.kiev.ua/~nanotwinning/iss3/
International SES Laboratory website: www.iop.kiev.ua/~nanotwinning/seslab/
Article collection Nanotechnology and nanomaterials (NANO-2013) by Springer Open Access Journal Nanoscale Research Letters <http://www.nanoscalereslett.com/series/NANO-2013>
Article collection Nanotechnology and nanomaterials (NANO-2014) by Springer Open Access Journal Nanoscale Research Letters
<http://www.nanoscalereslett.com/series/nano2014>

Related information

Result In Brief[New nanotechnology era for Ukraine](#)**Documents and**[final1-project-broshure-2015.pdf](#)**Publications**

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[Regional Development](#)

Information source: SESAM

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Permalink: http://cordis.europa.eu/result/rcn/173269_en.html

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