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Lisbon agenda: „Towards a European knowledge-based society and economy!"

INSTITUTIONAL DEVELOPMENT PLAN OF THE „INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU FIZICA MATERIALELOR" (NATIONAL INSTITUTE OF MATERIAL PHYSICS-NIMP) (2012-2016)

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1. Scientific SWOT analysis

In order to establish the NIMP strategy until 2016 we performed an extensive analysis of **strengths**, **weaknesses**, **opportunities** and **threats** (see Table 1). The strengths and opportunities follow naturally from the main achievements of the Institute which are summarised bellow:

- The scientific research activity at NIMP is competitive at international level, being consequently disseminated through a large number of internationally recognized results published in highly ranked ISI journals; NIMP also has a substantial amount of invited lectures and communications in international and national conferences. In the last 5 years people at NIMP published 160-200 papers/year, the average number of papers showing a slight increase. It has to be pointed out that the number of papers published in non-ISI journals decreased considerably (from 44 in 2006 to only 22 in 2010). Moreover, 27 books have been published in the last 5 years (18 books or chapters by international publishers and 9 by national publishers).
- NIMP has unique research equipments for preparation and characterization of various samples, some of them being the top-class at national level; this substantial up-grade was achieved along the recently concluded project from structural funds (Sectoral Operational Program-Increasing the Economic Competitiveness/POS-CCE). About 10 million of euros were devoted in the frame of the project to the creation of new research infrastructure and to the modernization of the existing ones, the aim being to create an „Euro-Regional Centre for the Study of Advanced Materials Surfaces And Interfaces" (CEUREMAVSU).
- NIMP participates in national projects both as the leader institution and partner. At present (i.e. 2011) NIMP is involved in: 3 Core projects (financed by the National Authority for Scientific Research-ANCS), 80 projects financed by the Executive Unit for Funding High Education, Research and Innovation (UEFISCDI) among which 3 are Ideas complex research projects (1 as leader, 2 as partner member), 22 Ideas research projects, 11-Human Resources projects, 44 Partnerships projects in priority topics (9 as the leader institution and 35 as partner), 2 projects in the frame of the common program between Institute of Atomic Physics (IFA) and CEA-France, and 5 Euratom-EFDA projects.
- The NIMP research quality is internationally recognized: NIMP is involved in 2 FP7 excellence networks, 1 FP7 project (Large Scale Collaborative Project) – acronym IFOX, an FP7 Marie Curie network on Particle Detectors (MC-PAD) , 4 COST actions, 1 HASYLAB project, 3 Erasmus and Brancusi projects, 4 bilateral projects based on Capacities 3rd Module. NIMP also collaborates with more than 40 research institutions from USA, Germany, France, Japan, Spain, Italy, Norway, Holland, Greece, Portugal, Turkey, China, India, UK, Belgium, etc.;
- High potential for technological development (NIMP has obtained 8 national and 15 international (USPTO, EPO, JPO and WIPO) patents in the last 5 years) new products and technologies with addressability towards given sectors of the developing market.
- Educational activities consisting in Schools for specialization and perfection in methods and advanced characterization techniques for materials and nanostructures. Through its highly qualified Senior Researchers 1st degree and PhD supervisors, NIMP constantly leads diploma theses, Master theses and PhD. Programs.
- NIMP has traditional research partners in universities and industry in the following domains: condensed matter physics, chemistry (catalysis, zeolytes), devices (ultrasonic traductors, thermistors, bolometers, etc), environment protection and its monitoring (sensors), etc;
- NIMP has its own computer network and a web page (**www.infim.ro**);

- NIMP is the co-editor of the Journal of Optoelectronic and Advanced Materials (JOAM), Digest Journal of Nanostructure and Biomaterials (DJNB) and Optoelectronic Materials – Rapid Communications (OAM-RC), all being ISI journals. The Editor-in-chief Editor is also a NIMP Senior Researcher (Dr. Mihai Popescu);

- NIMP organised or co-organised 12 international events (conferences, workshops, symposia)

• **Strengths (internal origin)**	• **Weaknesses (internal origin)**
• Highly qualified personnel (higher studies~73%; accredited research personnel ~ 66%; PhDs ~ 56 % , PhD students ~ 19 % of the personnel with high studies; PhD supervisors: 16); • Endowments with last generation equipment through POS-CCE project and several Capacities projects; endowments with unique instruments at national level; • Substantial amount of ISI papers (~ 170/year); invited lectures and communications in international and national conferences. • Strong potential for technological innovation, new products and new technologies, confirmed by patents obtained in the last 5 years; • International collaborations (inter governmental and bilateral agreements with institutes and universities from Germany, France, USA, Italy, UK, Spain, Japan, Belgium, etc.); • Reasearch visits at prestigious international institutes; • Educational activities related to Diploma theses, Master and PhD theses. • The existence of traditional partnerships with national research institutes and universities. • Performant computer network and web page.	➢ The number of international research grants obtained by NIMP is too small (e.g FP 7); ➢ In some research groups the average age of the personnel is quite high; on the other hand, some of the researchers left NIMP in favour of research institutes from EU (brain drain). ➢ NIMP faces a deficit with respect to the highly qualified *technical* personnel. Consequently, the highly qualified *research* personnel has to spend time on technical problems instead of devoting themselves to research activities only. ➢ A rather poor connection to the hi-tech industry. ➢ Insufficient resources for technological transfer process; ➢ Not enough publications in journals with ISI impact f_{ISI} >5; ➢ Poor institutional advertising through mass-media; ➢ Very few foreign researchers had research visits at NIMP

• **Opportunities (external origin)**	• **Threats (external origin)**
- Strong international collaborations; -International recognition of the research quality (invited lectures, post-doctoral and doctoral studies (including 'cotutelle' programs), publications with high ISI impact factor, citations, books and book chapters,etc.; - Longstanding scientific and technological capacity; addressability towards a developing sector of the market and towards the educational system; - Ability to involve in interdisciplinary research (nanoscience, biomaterals, biosensors, quantum computers, bionics etc.) - The increasing need for scientific and technical results, as well as the changes in the 'OG 57/2002' regarding the research funding.	o The lack of requests from industry and the lack of a suitable infrastructure for stimulating a closer relation between the economical environment and research; o Fluctuating policies with respect to the scientific research; o Limited recruting resources; the educational level of the graduate students rarely meets the high standards of the present condensed matter physics and nanoscience; ○ Low attractiveness of a research career, poor appreciation of the research career at political level and poor popularisation of the research results. o The acquisition system is ineffective and unsuitable to the scientific research environment; o Hierarchical dependence on a single ministry (MECTS); unable to take independent decisions; o The risk of increasing physical and moral wearing out of the equipment through inappropriate use caused by the lack of continuous funding. ○ A possible drop of the on-line access to the specific journals caused by the lack of funding and by poor planing strategy.

Tabel 1. The SWOT analysis relevant to the institutional development plan of NIMP 2012-2016.

The present SWOT analysis shows that NIMP has many strengths and considerable opportunities. Nonetheless, NIMP has to reduce its weaknesses and to stand the threats which could develop in the future. The NIMP staff should find solutions to the weaknesses identified above. On the other hand, efforts should be spent to fully exploit the opportunities and to protect the institute from the external risks. The proposed development plan suggest some possible solutions.

2.Strategic scientific objectives and directions

The scientific activity of NIMP is focused on modern experimental and theoretical aspects of condensed matter physics and materials science: the properties of nanosystems, thin and ultra-thin films, surfaces and interfaces, nanoscale taylored materials; the properties of some new materials subjected to compositional and/or structural changes; modeling the materials properties through unconventional physical treatments.

The main research topics are devoted to the investigation and modeling of the physical properties of new types of compunds and multifunctional materials, with emphasize on the ones with potential applications in high-tech sector. Among these topics one finds: materials having ferroic properties (i.e. ferromagnets, ferroelectrics, piezoelectrics, ferroelastics, multiferroics), superconductors, semiconductors, massive dielectrics (ceramics and monocrystals), nanosystems (nanoparticles, nanotubes, surfaces), quantum phenomena in mesoscopic systems, refractory compunds.
The materials investigated at NIMP are of interest and could serve for applications in micro, nano and optoelectronics, communications, processing and data storage, sensoristics, security and environment, energy storage and production, medicine and bio-engineering, etc.

NIMP has more than 140 highly qualified specialists, many of them being internationally recognized. Consequently NIMP plays a key role at national level in the research on advanced materials and in nanoscience, being also a leader in the Eastern European region.

The development strategy of NIMP for the period 2012-2016 has been written down by taking into account the NIMP mission (as stated in the constitutive documents of NIMP), its main objectives and the following aspects:

- The visibility and competitiveness of the reseach performed at NIMP (both at international and national levels) in condensed matter physics, nanoscience and materials science.
- The prioritary research directions (european/global), including the ones emphasized in

  PC7-PC8 projects, EURATOM projects, some of which are in strong correlation to the research topics and tehnological development directions specific to NIMP;
- The thematic areas of National Programme for Research, Development and Innovation -2 until 2013 and the research topics of the NIMP's Core Programme;
- The need to correlate the NIMP's research activity to market demands for new materials, technologies and services;
- The increasing opportunities for international collaborations (some of them have been already used) provided by the EU integration;

On the scientific side the NIMP's institutional development plan is based on:

- The most recent trends and problems in condensed matter physics, nanoscience and materials science (including nanomaterials);
- The existing and the foreseen research infrastructure and endowments;
- The human resource and its level of qualification and specialization;

- The existing international and national collaboratios as well as the perspective of extending them;
- The previous experience and demonstrated competence of the research personnel.

2.1 Objectives

- To concentrate the research at NIMP on highly relevant problems both from the fundamental and applications points of view.
- To enhance the role of NIMP in basic research on condensed matter physics.
- To encourage the applicative research and to capitalize the results through technological transfer and specialized services.
- To increase the visibility of the NIMP's results by publishing papers in journals with high ISI impact factor and by participating in top international conferences.
- To extend the international collaborations and to accelerate the integration in the european and world scientifical space by joining FP7 & Horizon 2020 research projects, the NATO and EURATOM programs and by establishing governmental and bilateral cooperations;
- To develop partnerships with SME research units (both public and private) and with universities from EU and Romania;
- To host a type 2 UNESCO center whose activity will be mostly focused on advanced theoretical studies in condensed matter physics and on educational activities oriented towards young researchers from countries with an emerging economy; the center will have strong connection to ICTP Trieste;
- To strengthen the partner position in view of establishing an European Infrastructure distributed around ELLETTRA synchroton facility; other partners involved are Austria, Italy, Czech Republic, Slovenia, Serbia, Croatia, Hungary and Poland.
- To participate in the construction and starting of ELI-NP project, the third pillar of the ELI distributed infrastructure (the other two pillars are located in the Czech Republic and Hungary).

2.2 Scientific directions

The previous analysis lead to the following prioritary research directions for the time interval 2012-2016:

1. **Condensed matter physics – phenomena and processes in nanosized systems, surfaces and interfaces;**
2. **Synthesis and characterization of nanomaterials and nanostructures;**
3. **Functional materials and structures of technological impact.**

Starting from these directions the research plan of NIMP is organised as follows:

MAIN THEMES OF THE INSTITUTIONAL RESEARCH PLAN 2012-2016

The first research theme has a pronounced fundamental character while the second theme is mostly focused on applied and oriented scientific research.

A. ***FUNDAMENTAL STUDIES IN CONDENSED MATTER PHYSICS***

- **Size effects in nano-objects and quantum structures;**
- **The role of surface and interface in structured materials;**
- **Electronic correlations and magnetic interactions;**
- **Modeling and simulation of the microstructure dynamics through computational physics methods;**
- **The field-matter interaction at micro and nanoscale.**

B. ***NANOSTRUCTURES AND MULTIFUNCTIONAL MATERIALS***

B1. ***Materials for energy***

- **generation, conversion, transport and storage;**
- **alloys and compounds for nuclear fusion and fission reactors.**

B2. ***Materials with applications in hi-tech industry***

- **materials for high frequency electronics;**
- **materials for optolectronics, transparent electronics and spintronics;**
- **materials for information processing and storage;**
- **sensoristics for automatizations and control, security.**

B3. ***Materials with applications to biomedicine and environment protection***

- **bio-compatible and/or bio-functional materials;**
- **bio-sensors, chemical sensors and (photo)-catalysts.**

Besides the above mentioned fundamental and applicative research themes the NIMP activity will be extended through:

- Activities associated to European projects to which NIMP is affiliated;
- 'Training' and professional forming activities (in particular the organization of an Instructional Center of advanced methods for analysis and characterization of materials);
- Marketing activities in order to find potential beneficiaries for the products and technologies made at NIMP (with special focus on applications for environment protection, non-conventional energies, medicine, biology, etc.).

Actions supporting the institutional research plan

- To concentrate the human and material resources on the prioritary domains identified above in order to increase the research effectiveness as measured mainly by articles published in ISI journals with high impact factor;
- To train the research personnel and to extend and improve the technical infrastructure;
- To continue the up-grade process of the computer network and of the existing software packages (both the general and the specific ones); extend the on-line access to the main research equipment in the institute;
- To spot those research topics in the national and international programs which fit better to the NIMP's aims and activities in order to submit project proposals;

- To increase the funds for training and specialization courses;
- To enhance the dissemination of the results through publications, patents, conferences,'doors open day', participation at international exhibitions.
- To stimulate the interest in following a research career in condensed matter physics by proposing some projects for students and outstanding undergraduates; to advertise the condensed matter physics through popularization seminars;
- To spend more efforts in order to hire very good researchers from abroad (including diaspora); this would lead to an increased international visibility of the institute.

The present scientific strategy will guide the institutional development in the years to come. However, this strategy should be also flexible, allowing continuous adjustments according to the new trends and topics in the condensed matter physics and nanoscience. Such changes are expected given the fact that some specialized domains of scientific research evolve quite rapidly.

3.The human resource strategy

The human resource of the NIMP is organized as follows: t*he scientific personnel, the technical personnel and the administrative personnel (including as well the people involved in the institute's management).* Although the scientific personnel is directly responsible for the implementation of the above mentioned research strategy it has to be pointed out that technical and administrative personnel also play a well defined role and without it the Institute would not function.

NIMP has at present over 140 researchers covering the hierarchy Research Assistants (RA) – Senior Scientists 1st degree (SR1). More specifically, there are 108 PhD, 24 PhD students, 16 PhD supervisors. All these people provide the potential required in order to achieve the strategic objectives of the institute. NIMP has world recognized experts in condensed matter physics, nanoscience, materials science and the most recent characterization techniques.

In order to achieve the goals of the research plan in the next five years NIMP has to reach the following objectives in what concerns the human resources:

- Improving the professional performance of NIMP's researchers
- Look for a balanced increase of the research personnel (i.e. the newly hired people should uniformly cover the entire hierarchy);
- Adjust the age profile of the research personnel in favor of the young researchers; also NIMP should reach an optimal ratio between the highly qualified technical personnel and the research personnel;
- Set a partnership with the higher education system in order to establish an attractive scientific environment suitable for training the research human resource;
- Establish a UNESCO Center for Advanced Studies in physics (this Center is to be viewed as a distinct institution within the NIMP);
- Insure a normal 'pyramid' of the research personnel with respect to the RA-SR1 hierarchy
- Introduce the IDT hierachy for the technical personnel with higher education.

- Increasing the PhD students and PostDocs number.
- Stimulate the outstanding graduate students to follow a research career (by providing satisfactory financial support and equipment);
- Enhance the scientific and tehnical expertise of the research (physicists, chemists etc.) and technical personnel in modern characterization and preparation methods of materials and nanostructures;
- Stabilize the young research personnel through appropriate measures (i.e. prevent the brain drain process);
- Access reintegration grants for performant romanian researchers from diaspora;
- Use the bilateral scientific agreements and the research grants obtained by NIMP to increase the numbet of guest scientists;
- Establish excellence centers around the internationally recognized personalities (funding excellence)
- Increase the international and national mobility of NIMP's researchers through international collaborations;
- Insure an optimal ratio between the research personnel and the administrative personnel ;
- Increase the efectiveness of the administrative personnel;
- Encourage the use of the appropriate software by the administrative personnel in order to increase its efectiveness and to reduce the bureaucratic duties of the research personnel.

In order to achieve these goals the following measures will be implemented:

- Improve the qualifications of the technical and research personnel by supporting training courses, doctoral and postdoctoral programs in performant institutes from abroad;
- Establish a training Center focused on modern materials characterization methods;
- Develop educational activities in partnership with the universities (e.g. organize common practical labs for students, assist and coordinate Master theses, supervise PhD programs and guiding the students towards recent and highly relevant research topics).
- Continue to impose high professional standards for the personnel admission (i.e. hiring) in the institute; a gradual implementation of a differentiated system for both permanent or temporary positions; keep and/or strengthen the evaluation criteria for the higher education personnel; correlate the salaries to the professional performance of the research personnel.
- Stimulate young and promising experts in various domains (physics, chemistry, engineering) to join NIMP (e.g. opening specific temporary positions);
- Reduce and eliminate if possible the fluctuations in the number of young specialists by bringing the salaries closer to the EU standards and by extending the participation in european programs focused on training and mobilities.
- Extending the leave of absence for the researchers that join other research groups for long and medium terms in the framework of international collaborations; realize a better connection to the European programs and insure access to performant equipments.
- Allocate funds for doctoral and postdoctoral scholarships on the main research topics in the institute.

- Improve the advertising procedure for the open positions at NIMP in order to receive applications from the foreign researchers as well.
- Introduce specialized software for the acquisition, financial, human resource and archiving departments, etc.
- Identifying financial and material stimulations in order to keep the outstanding and performant researches in NIMP (i.e. preventing the brain-drain scenario).

4.Mechanisms for stimulating the appeareance of new research directions

As mentioned above, the scientific development strategy is flexible and will be adjusted by taking into account the appeareance of other research directions in the institute. In order to properly identify and stimulate new research topics at NIMP the following things have to be done:

- Permanently follow the trends in the international research, special attention being payed to the topics that meet the fields of expertise at NIMP;
- Permanently follow the demands of the social and economical environment from the scientific research and contribute in finding solutions through the specific expertise provided by the human resource of NIMP and by the existing infrastructure.
- Encouraging the mobilitity of the personnel (from NIMP and towards, NIMP), especially for PhD students and PostDocs; encouraging ideas exchange and collaborations with partners from abroad and from other national institutions.
- Substantially participate in international scientific events, the main goals being to exchange ideas and to initiate collaborations and partnerships on common research themes;
- Set up specific financial mechanisms for supporting extended research visits and/or temporary contracts for internationally recognized experts in order to develop new research topics;

In quantitative terms, we aim at the following:

- To have at least 10 PhD supervisors by the end of 2016 (here one should have in mind that the new legislation concerning the 'habilitation' will shorten the number of PhD supervisors in NIMP from 15 to 5 in 2012 – it is therefore mandatory to encourage more researchers from NIMP to devote themselves to get the 'habilitation').
- Doubling the participation to international conferences (the reference year is 2010).
- Increase by 50% the number of international collaborations with research institutes from abroad. To this end the institute will apply for a new type of research grants called Lab Twinning - this funding mechanism is expected to be announced by ANCS in 2012.
- Promote and include new research themes in the proposals for 'Ideas' grants; encourage and stimulate the young researchers to apply for grants for Young Researchers (TE).

5.Financial SWOT analysis

The financial strategy of NIMP is nowadays a multi-parameter problem as the institutional evaluation of the R&D institutions in view of accessing the Core and Performance funding is still not concluded yet. Nonetheless, due to the recognized leading position of NIMP in the fields of condensed matter physics and advanced materials one expects a top position of NIMP among other R&D institutes in order to secure the funding needed for the standard activities. Alternative present and future sources of funding are the National Programs (eg. Ideas, Human Resources, Partnerships, Institutional Performance, etc.), as well as participation in international programs (FP7, EURATOM, NATO). In the context of the existing funding schemes the following strategic measures have been identified:

1. Increasing the succes rate (SR) in national competitions to 50% - this is quite possible as the present SR is around 42%. In order to reach this goal: i) the project proposals to be submitted will be firstly analysed and discussed by the research staff (e.g. the scientific council) and ii) the human resources and the infrastructure will be suitably split in order to back-up the submitted project proposals.
2. Optimally tune and organize the financial components of the research grants obtained in various Calls (National Programme for Research, Development and Innovation -2, Programme of Sustaining Institutional Performance , Ideas, EURATOM, FP7) in order to suply continuous funding to the institute.
3. Further stimulate the participation to international calls.
4. Find the optimal balance between the personnel funding and the needed expenditures for infrastructure development; on one hand this would make NIMP more attractive for young researchers (both from financial and scientific environment points of view) and on the other hand will increase the NIMP's competititvity.
5. Improve the capacity of the administrative department to handle the financial and administrative aspects of the research grants in order to solve quickly any issues related to them.
6. Prevent any situation that could lead to a failure in paying the duties to the state budget or various services to collaborating partners.
7. In case of need use appropriate banking services to secure the funds for salaries.

Taking into account the above mentioned facts the financial SWOT analysis of NIMP reads as follows

Strengths (internal origin)	• **Weaknesses (internal origin)**
- An increasing number of research grants obtained in the last call (Ideas, HR). - Performant research infrastructure which creates the premises to obtain substantial institutional basic funding in order to insure the full capacity functioning of the main equipments and their maintenance for the next 5 years. - The good international visibility of the scientific results argues for a substantial institutional performance funding.	➢ The NIMP's funding is mostly obtained from a single institution (MECD-ANCS) through public programs; ➢ Lack of a stable and predictible institutional basic funding; ➢ Fluctuations of the investments funds;
• **Opportunities (external origin)**	• **Threats (external origin)**
- Increased stimulation to participate to international calls.	- Financial blocking. - Rigid and extensively administrative funding schemes. - Lack of demands from industry and the lack of a suitable mechanism for strong connections between the research and the economical environment. - Fluctuating policies with respect to to scientific research.

Tabelul 2. Financial SWOT analysis.

6.Infrastructure: investment plan and strategy

The strategy for infrastructure development is obviously correlated to the scientific development plan. Nevertheless one should have in mind the following aspects:

- 90% of the present infrastructure was acquired in the last 4 years, in all cases being selected state-of-the art equipment; as a consequence the immediate interest is to fully and optimally exploit the existing infrastructure before its moral and physical wear.
- in the next few years we do not foresee major funding of the Capacities Programme at national level;
- also, at national level ANCS will strongly discourage acquisitions that will simply multiply the existing equipment, the risk in this case being that some of them will be used under their capacity (especially the ones with high costs for functioning and maintenance).

Objectives and actions to be taken

In this context the NIMP will adopt the following strategy:

- To maintain the existing infrastructure at standard functioning parameters needed for performant research activities; further development of the infrastructure and acquisition of new equipment will be accepted ONLY if i) some new research directions emerge, ii) NIMP receives demands for special services which require an infrastructure not available or insufficient at present.
- To create specific structures:
  - Accredited centers/labs for testing and characterization of materials and structures at an macro and nanoscale;
  - Specialized labs;
- Extend and improve the existing computer network;
- Extending the NIMP's buildings in view of new research topics (e.g. crystal growth, extreme condition synthesis – i.e. high pressures, intense radiation fields etc.)
- Continuing the rehabilitation of working spaces, especially of those that are designed to host the new infrastructure and equipment;
- Insure the utilities network and the services needed for the appropriate functioning of the institute viewed as an integrated research infrastructure.

7.Technology transfer and the attraction of non-public funds

The technological transfer of the research results to the production units is a critical issue even at european level. The European Comission frequently criticizes the academic medium for the existing fracture between the researcher's 'universe' and the industrial sector, especially with respect to the wellknown difficulty of finding a common language and common actions.

While the EU holds the records for publications and theoretical papers in the field of advanced materials, other countries (e.g. Japan for titanium dioxide applications) own specific markets. The task

at the european level is to forge a stronger coupling of the research to the market's needs in order to recover more quickly the investements put into various domains.

The Romanian research is a particular case, as the large industrial units have foreign owners which do not contact the national research institutes in order to competitively solve specific problems.
Based on the worldwide trend in the field of advanced materials, nanomaterials and nanostructures and taking into account the existing (highly qualified) human resource, the present infrastructure and products and technologies developed so far, NIMP sets the following **goals**:

- Perform oriented and applicative research activities in domains of high relevance and interest at international level, in the framework of complex projects with appropriate objectives and strategies;
- Create „spin-off" companies (by taking into account the marketing analysis and the estimates on the required investments);
- Providing technological support for European infrastructures (e.g. ELI).
- Providing a broad range of services to the economical medium, especially related to the structural characterization, compositional analysis and the analysis of the physical properties relevant for applications (superconductors, ferroics, optics, dielectrics, photovoltaics, etc.).

Actions

In order to implement an optimal strategy for achieving these goals the following actions have to be taken:

- Identify those market sectors potentially interested by the NIMP's research activity;
- Inspect the themes and topics leading to direct industrial applications and include them in FP7-Horizon 2020, National Programme for Research, Development and Innovation -2 and other national research projects;
- Enhance the partnership with applicative research institutes and SMEs, by taking advantage of the FP7 opportunities;
- Establish a Center for specialized training in modern methods of characterization for materials, structures and devices (HRTEM, RES/ENDOR, XPS, XAFS, Raman, Mössbauer, FTIR etc);
- Develop consulting activities and provide scientific services for the economical medium;
- Advertise the NIMP's capabilities to provide specialized consulting in:

- science of nanosubstances and nanomaterials with applications to nanotechnologies;
- detection and identification of dangerous materials.
- photocatalysts for depolution (water/air) and self-cleaning (constructions/roads)

- Extend the activities ending in patents and technological transfer;
- Perform active marketing focusing on the transfer of the scientific results obtained in the institute;
- Enhance the advertising activities, including at international level, by a stronger participation to international and national exhibitions and markets.

8.Strategic partnerships and visibility: events, communications, collaborations

In the next years considerable effort will be spent on strenghtening the position of the Institute at national level and to confirm NIMP as a Center of Excellence at international level. Another important factor in mantaining and improving the NIMP's visibility is a constant flux of publications in prestigious international journals. The impact of the results will be measured through the number of citations gathered from research groups from abroad.
In the same time one should pay attention to:

- Establishing partnerships with prestigious international institutions;
- Actively contribute to large research infrastructures e.g. ELI-NP or to the Elletra-Trieste syncrothron infrastructure distributed in central and east european countries;
- Inviting internationally recognized scientists to give invited lectures at NIMP on current interest topics;
- Organize exploratory workshops with common participation of reasearchers from NIMP and from foreign institutes in view of identifying future collaborations.
- Organize specific seminars where the research results will be presented to potential users and beneficiaries from the social and economic media.
- Organize an Doors-Open Day at the Institute with the precise aim to attract undergraduate students to a research career.

The expected quantitive results for the years to come are the following:

- ☐ NIMP will be partner in at least 2 european level research infrastructures.
- ☐ At least 10 foreign PhD students and/or PostDocs will join NIMP
- ☐ Organize at least 3 international events (focused workshops)
- ☐ A 50% increase of the international collaborations
- ☐ Organize the Doors-Open Day at NIMP.
- ☐ Enhance the efforts to attract valuable foreign researchers (including diaspora) to join NIMP through mid and long term contracts, in order to increase the international visibility.
- ☐ Increase the funding for specialization and perfection probations.
- ☐ Organize at least 2 workshops dedicated to the presentation of NIMPs' results to the economical medium.