3. The 4 years development institutional planning (maximum 15 pages)

The mission of the National Institute for Earth Physics (NIEP) is:

- Monitoring of seismic activity in Romania
- Expansion of the boundaries of scientific knowledge, its creativity and efficiency increase through fundamental and applied researches in Earth physics domain, in general, and seismology domain, in particular.

The 4 years institutional development planning represents a set of objectives, politics and action programs designed and implemented in order to properly fulfil the mission and the declared purposes of NIEP during the 2012-2015 time interval.

The strategic plan is an overview of a series of fundamental factors on which depend the results of the proposed strategic policy:

1. Scientific research strategy and technological transfer;
2. Investments strategy;
3. Human resources strategy;
4. Financial strategy;
5. Intern and extern partnership strategy;
6. Management strategy.

The Present Strategic Plan is adapted to the newest real issues of the research-development and innovation in the Earth Physics domain and has to become a determinative factor of economic development and population protection against the destroying action of earthquakes.

3.1. SWOT Scientific analysis

Strong points:

Human resources in reseach domain

1. Expertise in seismology; partly this expertise is exclusive for Romania
2. Staff with teaching and scientific valuable experience;
3. Ph.D. theses carried out within the Institute;
4. The existence of numerous Ph.D. students working in the institute;
5. Existence of international bilateral cooperation agreements;
6. Training courses and working stages in international centres;

Research financing

7. The financing program of the Institute coordinated by the Ministry of Education, Research, Youth and Sport – National Authority for Scientific Research;
8. Allocation, from proper income, of funds to stimulate the research of young Ph.D's;
9. Collaborative contracts with companies and institutions from the whole country.

Research politics; development of primary domains and organizing of research activity

10. Existence of some chairs/departments with developed research activity;
11. Organization of complex structured research centers;
12. Stable and active partnerships with other research centers;
13. Active participation in real-time seismological networks at European and regional levels.

Infrastructure

14. Existence of an advanced infrastructure with the possibility of integrating any new type of equipment (sensors, communication, storage);

15. Existence of a high quality database;
16. High performance research equipments;

Quality policy

17. Revival of scientific research activity of NIEP;
18. Increasing participation of NIEP in the scientific academic life of Romania, by grants, articles and books published at inner publishing companies, research centres, etc.

Research activity management

19. Proper management of scientific research activity;
20. Informing in due time about the national research programs;
21. Existence of people responsible for each major research direction and for proper correlation of the activities;
22. Capacity of organizing national and international scientific events.

Weak points:

Human resources in research domain

1. The low quality of the preparedness degree for graduates in geophysics domain; the decrease of the preparedness level for basic sciences (mathematics, physics, geology, engineering, etc);
2. Low number of M.Sc. students with thesis containing adequate research elements;
3. Low number of students interested in research programs;
4. Educational activity carried out by researchers is scarce and unproductive;
5. Average age of the research staff is too high.

Research financing

6. Research activities are under-funded;
7. Lack of a clear definition of the research primary fields for NIEP; there is an excessive dissipation of the research themes;

Infrastructure

8. The low level of research infrastructure within the Universities. The research infrastructure is outdated from technical and also moral point of view, with few exceptions.

Quality policy

9. In many cases, the themes for M.Sc. and Ph.D. do not approach subjects in primary research domains;
10. National edited journals in geophysical domain have a limited impact in the international scientific community;
11. Number of books in international languages, published inside or outside the country, is very low;
12. Rate of publication in high-level international journals is low comparatively to the number of staff working in the research field;
13. Fulfilment of average level research themes with a low innovative degree, comparing to the primary international themes.

Research activity management

14. Stimulation of research performance is insufficient;

15. Inconsistency of the evaluating criteria of the scientific activity;
16. Absence of integrating interdisciplinary strategies;
17. Activities of marketing and exploitation of research results are very poor.

Opportunities

Human resources in research domain

1. Increment of the number of M.Sc. and Ph.D works in agreement with the Bologna process stipulations.

Research financing

2. Research programs launched by the National Authority for Scientific Research and other ministries;
3. National Research, Development and Innovation plans;
4. "eLearning" and "Erasmus Mundus" programs.
5. FP6 and FP7 programs, ESF (European Science Foundation) programs;
6. Governmental support (equipment of national interest, priority projects);
7. Increase of the economic activity, once Romania adhered the European Union.
8. European political context favourable for research, by creating the European Research Area;
9. Research politics for South Eastern Europe; development of priority domains, integration and organization of research activity;
10. EU politics for regional development providing funds from structural and social-economic cohesion programs.

Infrastructure

11. Development of infrastructure for innovation and technological transfer, using national and international sources;
12. Access to advanced modeling and inversion techniques;
13. Access to performance computation systems;
14. Advantages of fast internet communication.

Quality policy

15. Applying the evaluation standards of NCSRHE for the research quality at NIEP;
16. Increase of access to informative and formative sources to insure research quality (conferences, internal and international seminaries).

Research activity management

17. Access to the internal and international sources of information and formation, regarding the research activity management;
18. The interest and the pressure of the society.

Others

19. The Vrancea area represents, from geotectonic point of view, a higly interest area for seismological research, both at national and international level.

Risks

Human resources in research domain

1. A low number of M.Sc./Ph.D. students;
2. A small number of young people highly trained choosing a research career;
3. Low attractiveness for young graduates; export of intelligence.

Research financing

4. Development of great European research centres, which have the capacity and strength to attract important research funds;
5. Poor demand for research from industrial media;
6. Financial-accounting restrictions;
7. Low budgetary allowances for research domain;
8. Additional financing do not stimulate the development of research activities;
9. Necessary equipment for earthquake monitoring and seismic existing networks maintenance requires high state investments;
10. The financing insecurity of some permanent research activities (monitoring, catalogue, data base, etc.).

Research politics and management

11. Bureaucracy.

Infrastructure

12. Equipments for research and computation are subject of highly dynamic usage.

Quality policy

13. The researcher profession does not offer a long-term and well-defined professional status.

3.2. Strategic objectives and directions

According to the legal regulations in force **(HG 1313/1996, HG 702/2001** and **HG 1947/2004)**, the main objectives of NIEP are related to:

- Seismicity, earthquake monitoring and database management;
- Physics of the earthquake source;
- Structure and dynamics of the Earth interior;
- Seismic hazard and risk;
- Seismic engineering;
- Seismotectonic processes;
- Earthquakes prediction;

NIEP is strongly involved in the National Program for Seismic Management and Risk. As stated by the **HG 1313/1996**, NIEP is the only Institute in Romania which has as main objectives fundamental and applicative researches on:

- Seismicity monitoring and seismic hazard;
- Seismic microzonation of dense-populated cities in Romania;
- Evaluation and mitigation of seismic risk.

At the same time, according to the decision made in the Governmental meeting of 16.10.2002 (decision no. 5/11757/A.N.), where the "Plan for preventing local and central authorities on strong earthquake impact" was approved, the following projects were specified:

1) Early warning system **(EWS)** for industrial installations and other equipment of national priority in case of strong earthquakes;

2) Seismic hazard map of Romania;
3) Seismic microzonation of dense-populated areas;
4) Shakemaps;
5) Researches regarding the seismic tomography of some dams, in order to avoid catastrophic events.

Seismic monitoring and database management

A commitment to long term monitoring (i.e. continuing to record data on a continuous basis) and long term observation (i.e. using the geological record to extract the history of past events, and their impacts) requires long-term commitments to data archiving and data sharing, and continued investment in the infrastructure needed to process, visualize and model such data (i.e. high performance computing). For these investments and activities to have their maximum impact it is required continuous integration with international networks (both in Europe and beyond).

- Optimizing the procedures for seismic signal archiving, processing and transmitting;
- Optimizing the procedures for remote maintaining and monitoring;
- Data quality monitoring. Maintenance/quality proportion;
- Site selection for sensors installation;
- Establishing an optimum number of highest performance seismic stations (array type stations) and a geographical configuration for their emplacement;
- Increasing the mobility of networks for local investigations (pool of mobile seismic stations);
- Optimizing the cross-border monitoring;
- Integrating the national network into the international networks and accommodation to the European and global development politics. Active participation and integration into the virtual infrastructures of Earth observations (virtual seismic network of broad band and very broad band stations, EPOS - European Platform Observation System);
- A continued ability to respond rapidly to events of global significance, such as major earthquakes, landslides or tsunamis.

Source physics

Earthquake source modelling is a long-term task aimed at building quantitative physical models for the entire earthquake process, including tectonic stress accumulation, nucleation of rupture, and the dynamics of the rupture propagation and cessation. Integration of the multiple aspects of the earthquake phenomena, from the small-scale (dynamic rupture) to large-scale (plate boundary tectonics) processes is becoming of increasing interest to understand the seismogenic systems.

- Development of computational and analytical techniques to model, simulate, interpret, and, ultimately, to understand the physics of earthquakes;
- Focal mechanism and deformation field;
- Inversion techniques to constrain source parameters;
- Non-linear dynamics modelling for complex hierarchic systems;
- Modelling the pre- and after-shock processes

Earth internal structure

- Seismic tomography: body waves, surface waves, seismic noise;
- Earth crust dynamics;
- Refraction profiles;
- Anisotropy;
- Attenuation.

Hazard and risk
- Development of neo-deterministic approach for seismic hazard assessment;
- Geological hazard integration;
- Hazard generated by the human activity: climate change, slope stability, managed (or mis-managed) river paths, effects of dams;
- Time dependent hazard.

Rapid processing techniques for warning and evaluating earthquake consequences
- Development and optimisation of a rapid information dissemination system, in case of disasters;
- Use of satellite data;
- Developing rapid communication techniques and graphical dissemination. Upgrading efficiency of imaging management;
- Warning systems for disasters.

Risk management
- Use of satellites
- Systematic monitoring to support geo-hazards risk assessment and multi-risk management approach;
- Vulnerability mapping and risk assessment;
- Optimizing monitoring and processing integrated systems for natural disasters forecasting in the South-Eastern European region;
- Management and intervention common system in cross-border areas in case of disasters. Increase of interaction with neighbouring countries in case of destructive earthquakes;
- Optimizing the education, the information networks and decision taking systems regarding the mitigation of risk disasters).

Other scientific research and technological development activities
- Elaborating studies and researches of seismic emplacement for electrical-nuclear power plants and also for other objectives of national importance (dams, military constructions, bridges, hospitals, schools, etc.)

Improved connection with mass-media and civil community
- Rapid information and quick analysis on web, dynamically linked with various databases;
- To monitor and provide information such as seismicity, asperity map, tectonics, aftershock sequence, strong-motion records and GPS data on a special home page.

Teaching and education
- Delivering high-quality undergraduate degree programmes in Geological Sciences, Geophysics, Environmental Science, Environmental Management and Environmental Sustainability, all offering an excellent student experience and training graduates with skills to face grand environmental and social challenges from industrial, policy-making and research communities.

Research based education:
- Involvement of researchers in training process at post high-school levels;
- Integrating students in the research process during the preliminary steps of the studies;
- Permanent education;
- Attracting foreign students in M.Sc. and Ph. D programmes and also attracting foreign researchers into national programmes, through a proper financing and organizing system;
- Make geosciences knowledge more readily available to the education community; assist educators in creating tools and approaches for teaching Earth system science;

- Student integrating programmes in research activities;
- Use online ways for training;
- Attracting young people in research activity.

In order to develop world-class research and services, Geosciences must attract intelligent students in sufficient numbers, whether home grown or from overseas. This requires enduring government commitment to develop competitive career structures and to invest significantly in science programmes and infrastructure.

Development of interdisciplinary research directions
- Satellite-imaging of Earth surface deformation, surface processes, earthquake precursors;
- Data and knowledge that are interoperable between disciplines (flexible platforms);
- Better financial and structural support for pilot studies especially for interdisciplinary topics;
- Interface and transversal cooperation;
- Integration of research activities in solving social-economical issues of national interest.

Researches regarding the Romania neighbourhood seismic areas and those with high influence on Romania seismicity, using international collaboration programmes, at national or bi-lateral level.

Monitoring of nuclear explosion seismicity and other sources, ensuring the technical participation of Romania to supportive activities for applying the stipulations of the Preparatory Commission for the Comprehensive Nuclear-test-ban Treaty Organisation (CTBTO), approved in Romania by the low nr.152/1999.

Activities related to research-development activities, performed in the own domain of activity, as approved by the state authority for research and development, and if it is the case, by the authorized institutions

The National Institute participates in the achievement of some research-development activities regarding strategic and national defence domains and could develop also other activities, with the approval of the coordinating Ministry and with the approval of the Research-Development National Authority, according to HG nr.702/19 July 2001, art.3.

a) Participation to the elaboration of the domain strategy, coordination of the national projects of seismology and Earth physics;

b) Professional formation and specialisation: the Institute, along with other research centres in Romania and abroad, participates to training and specialisation of researchers in Earth physics domain;

c) Consultancy and specialised assistance: the Institute provides technical assistance, consultancy, scientific and technological services, as concerns the population protection against earthquakes and protection of the major risk industrial facilities in case of major earthquakes;

d) Services in exploitation safety domain in case of major earthquake, of objectives of national interest (Nuclear Power Plant - Cernavoda, dams, cultural and social-economic interest buildings, military objectives, bridges, chemical products reservoirs, etc.);

e) Participation to the technological transfer accomplishment.

3.3. Human resources strategy

The strategic plan is based on the assumption that human resources, and mainly of research employees, is the decisive factor in the development of NIEP. In the current context, the human resources problem for research domain represents a priority of major significance for NIEP.

Increasing the training level

- Supporting training programs in Earth physics, for high-school and university level;
- Auditing and updating the studying programs;
- Correlation of the research programs with those for university preparation at the Faculty of Physics and the Faculty of Geology and Geophysics;
- Increase of competences for the research employees coordinating Ph.D. and post-Ph.D. stages;
- Developing modules according to the requests of the society and market;
- Ensuring proper conditions for attracting foreign students;
- Opening grants at NIEP for foreign researchers, in order to increase the competition - funds for grants could be obtained from European projects;
- Training in High Performance Computing;
- Increasing the management capacity of the research employees by coordinating national in international projects;
- Maintaining a high level of exigency when new people are hired and gradually introducing a differential system for permanent jobs and for temporary contracts.

Increasing of networks of excellence and interdisciplinary networks

Earth observation activities are multidisciplinary and of benefit to several societal benefit areas. In this respect, NIEP can help other communities emerge and develop. Key objectives include: (i) interoperability between observing, modelling and information systems; (ii) data sharing and data dissemination; and (iii) optimization of observations and information for understanding and predicting environmental phenomena.

- Increasing the capacity to approach global and critical problems for the actual society;
- Supporting inter-disciplinary research teams;
- Encouraging multi-disciplinary programs and partnerships between different domains, in order to solve some global, environmental problems.

Developing external cooperation and partnership

Strengthening international partnerships using the opportunities of the UE programs, the NATO SfP programs, as well as bilateral cooperation regulated through governmental agreements.

- Supporting mobilities;
- Experience exchange and know-how export for countries situated in the Carpatho-Pannonian area, Danubian Basin and Black Sea area;
- Increasing the researchers' mobility, mainly for young ones, both on internal and external plan, ensuring the proper conditions to resume the activity after coming back in the institute.

Other strategic issues

- Setting an optimal ratio between academic research and marked-oriented research, following the requirements of the society;

- Improvement of dissemination of scientific results and know-how to decision making factors, government, mass-media;

- Using salary benefits and professional promotion in order to encourage the efforts done in/and for NIEP and stimulating the self-development of the employees, along with increasing the offer and the possibilities of obtaining decent income for the activity done for the Institute;

- Improving the salaries for researchers, based on performances, within national and international programs;

- Improving the competencies and the experience of prestigious researchers, retired due to age, by maintaining them as consultant researchers, Ph.D. leaders and research programs coordinators.

3.4. Ways to stimulate the appearance of new subjects and research themes

- Develop tools and processes to integrate data with models, and to exploit the new and continuing opportunities in technology and computing. Examples would include moving from our current ability to collect data across large-scale mobile environmental sensor arrays, or to collect multiple high frequency measurements to turn this into an ability to integrate and interpret these data and thereby advance our understanding of the underlying processes;
- Provision of long time series of observations is fundamental to the progress in Earth sciences. Such observations are crucially important for detection of trends having a slow rate of change. The data must also be well calibrated and cross-calibrated with data from other sources;
- Extending probabilistic hazard assessment: to quantify and propagate uncertainty throughout our hazard models; to close the circle from an understanding of the physics of the process to the consequence of the event across the range of spatial and temporal scales of interest to society; to build networks with researchers in disciplines outside natural science, in order to properly understand how hazards translate into risks; to engage with the public, particularly in the areas of understanding and communicating uncertainty;
- To understand the forcings and feedbacks between environmental change and natural hazards, and in particular to understand the links between deep Earth and Earth surface processes;
- Participation in large geosciences projects initiated in Europe and in World;
- Correlating research programs with the university program at the Faculty of Physics and the Faculty of Geology and Geophysics. Some of the M.Sc. students from the Faculty of Physics have dissertation themes settled by NIEP.
- Increasing the competencies in taking action in case of natural disasters, using an integrated educational and research system.

<u>Developing external cooperation and partnership</u>

- Accelerating the integration of young people in high quality research problems;
- Permanent and periodic evaluation of the research activity;
- Adding an international dimension and outreach component to the national activities;
- Data harmonization and better access - GEOSS (The Global Earth Observation System of Systems) strategy. Integrating observing components, so that the scientific community should have easy access to and make optimal use of data from different sources;
- Participation at GEO (Global Earth Observations)

- Identify the societal benefit areas in order to achieve an optimized data base in technical, operational and funding terms;
- Development of the regional (Banat, Crisana, etc.) and transnational (SEE - South East Europe Transnational Cooperation Programme, 2007 – 2013) monitoring networks;
- Cross-border cooperation in environmental protection domain.

Integrated monitoring and processing systems for natural disasters forecast, in South-Eastern Europe

One of the priorities refers to THE ENVIRONMENT, and in particular to the EARTH OBSERVATION. Emphasis is on the optimization and integration of the measuring networks and the achievement of common procedures and standards. Taking into consideration the fragmentation of SEE area, one top objective for the European programs would be optimizing the data exchange and integrating it into a unitary monitoring and processing system.

Possible themes:

1. Optimizing the monitoring and processing system in SEE, regarding modelling and forecasting natural disasters (Integrated monitoring and processing systems for natural disasters forecast, in South-Eastern Europe);
2. Common management and intervention system in cross-border area in case of disaster;
3. Optimizing the education, the information networks and the decision taking systems regarding the reduction of the risk for disasters (Increasing the competencies in taking action in case of natural disasters, using an integrated educational and research system).

3.5. SWOT financial analysis

Strong points:

- Previous evaluations of the Institute lead to its re-accreditation as National Research and Development Institute;
- Efficient planning of the incomes and expenses, efficient administration and development of the research and development (see table below for 2010 as reference);

thousands lei

No.	Indicator name	Achieved 2010	Forecasted					Δ
			2011	2012	2013	2014	2015	
1	Income from basic activity	11289	14011	14742	15243	15670	15608	18829
2	Income from research connective activities	168	126	133	138	142	143	-158
3	Other income	2436	1920	1281	1325	1363	1546	-4745
4	Financial income	31	43	44	44	45	45	66
5	Total income	13924	16100	16200	16750	17220	17342	13992
6	Expenses for goods and services	655	3255	3338	3310	3694	3623	13945
7	Employee	8803	9282	8294	8860	9100	9350	871

	expenses							
8	Other expenses	4060	3075	4059	4061	3901	3843	-1361
9	Financial expenses	0	18	19	19	20	20	96
10	Total expenses	13518	15630	15710	16250	16715	16836	13551
11	Raw outcome	406	470	490	500	505	506	441
12	Productivity	3	3	3	3	3	3	0
13	Debts		0	0	0	0	0	0
14	Claims	25644	25644	0	0	0	0	0
15	Investments allocation	736	152930	5573	5768	5800	5850	172241

Δ = variation relative to the reference year (2010)

- Efficient handling of human resources and its motivation for performance (see table below for 2010 as reference)

No.	Indicator name	Achieved 2010	Forecasted					Δ
			2011	2012	2013	2014	2015	
1	Average employee number,d.c	111	109	108	106	106	105	-21
	RD	76	76	76	76	76	76	0
2	Average raw salary per month/total,d.c	5027	5550	5005	5447	5595	5803	2265
	RD	5838	6438	5806	6319	6490	6731	2594
3	No. of people SR1+SR2	15	17	15	15	15	15	2
4	% SR1+SR2 total of RD employees	20	22	20	20	20	20	2
5	No. of people involved in M.Sc. and Ph.D	15	16	16	16	16	16	5
6	% people involved in M.Sc. and Ph.D total RD	20	21	21	21	21	21	5
7	No.of researchers under 35 years old	14	16	16	16	16	13	7
8	% researchers under35 years old in RD	18	21	21	21	21	17	11

Δ = variation relative to the reference year (2010)
SR = Senior Researcher

- there are no fiscal debts un-paid at the expiration date;
- there are no clients or prescribed debts;
- the existence of unique expertise on one or more levels;
- holding some invention licenses for products and/or technologies which offer a competitive advantage to the Institute;
- holding some special abilities regarding the innovation of products and/or technologies;

- holding the leader or top market position;
- a favorable general image about the Institute;
- a well-organised and efficient system of strategic planning;
- fast decision making reaction to the intern/extern modifications.

Weak points:

- Diminution of financing due to the economic effects of the general economic crisis;
- Existence of some facilities which have to be permanently updated according to European requests;
- Vulnerability to competitive pressures;

Strategic management is characterized, in essence, by a continuous analysis of the external environment, in order to anticipate or observe in due time its changes, and of the internal status of the institute, in order to evaluate its capacity to overcome changes. This kind of analysis will be useful also to potential investors or financial consultancy companies.

Opportunities:

- Diminution of financing due to the economic effects of the general economic crisis;
- Fast development of the market;
- Possibilities to extend the products and/or services nomenclature;
- Request for new products/services on existing or new markets;
- Request of existing products/services on new markets;
- State of stagnation or decline at the competing companies;
- Possibility of signing up some profitably alliances, agreements etc.;
- Possibility of signing up some contracts with private parts.

Risks:

- Adoption of some restrictive rules or regulations restrictive with disadvantageous impact;
- Entering an economical recession period at national and international level;
- Slower increase, stagnation or even fall in of the market;
- New competitors entering the market;
- Increasing pressure of competition;
- Vulnerability to the changing business environment.

3.6. Infrastructure: investment plan

Optimisation of observing systems and networks should be considered as a top priority task for Romania, bearing in mind the fact that Romania is an earthquake prone area. The example of the European meteorological observation network is given, in which observing stations had to be reshuffled for optimal coverage of the continent several years ago.

- The consolidation of the Seismological Observatory "Cuțitul de Argint" in Bucharest, the oldest Observatory of Romania, built in 1898. The observatory is considered a historical monument, where the catastrophic earthquake of 10th of November 1940 was recorded;

- Accomplishment of a seismic integrated system in Dobrogea area, for earthquake monitoring for the Nuclear Power Plant at Cernavoda, activity requested by IAEA (International Atomic Energy Agency) from Vienna and accomplishment of a warning system for tsunamis in the Black Sea;

- Total renovation of the Seismic Observatory of Medias - the only Observatory in Transylvania area.

Research infrastructure development at NIEP:

- Acquisition of 300 digital accelerometers, the price of each instrument being around 15.000 $. This equipment is necessary for creating real time evolution maps (Shake Map) for earthquakes from Vrancea area;
- Acquisition of 40 real-time GPS equipments, used for observing the dynamics of the crust, system which will be integrated in the European infrastructure (EPOS program);
- Installing 50 seismic stations in boreholes (>50 m depth), for increasing the signal/noise ratio and recording of micro-earthquakes;
- Acquisition of precursors monitoring equipments for earthquake prediction domain;
- Acquisition of equipment for seismic investigations (georadar - Ground Penetrating Radar, mobile seismic stations, etc);
- Acquisition of 3 A0 scanners, necessary for historical seismograms scanning and also for creating a digital database;
- Developing the existing computing network and increasing the transmission speed up to around 100 Mb/sec; increasing the information system by extending the local network and creating a specific database and software packets, which could be further exploited.

3.7. Sustaining the technological transfer and attracting extra-budgetary funds

- Attract local funding;
- Addressing subjects with social-economical impact (geo-hazards, seismic investigation for objectives of national interest, dams safety, implementation of early warning systems, shakemaps, seismic risk mitigation in urban areas, development of standards);
- Real-time seismic risk evaluation

Dissemination towards potential users and population of relevant results

Development and optimization of a fast information dissemination system in case of disasters.

- Using modern techniques for information and communication;
- Developing appropriate strategies for communicating with policy makers, opinion makers and the interested public;
- Searching some potential beneficiaries of the research results, mainly regarding those applied for anti-seismic protection, emplacement of strategic objectives, earthquake prediction, etc.

The real time seismic warning system (**EWS - innovation licence nb.118234**), system which is already installed at the nuclear installation at the National Institute of Physics and Nuclear Engineering - Măgurele and other nuclear centres in Romania, can release a warning within the first 5 seconds after recording the P wave to take **preventive measures in case of strong earthquakes from Vrancea area**. EWS can be implemented to shut down dangerous industrial processes, before the arrival of seismic waves. The real time ShakeMap, using the ground movement, is a new product applied at NIEP and will be a starting point for instant estimation of damage after the generation of an earthquake.

3.8. Strategic partnerships and visibility: events, reports, collaborations

The extension of national and international visibility of the research and innovation activities of the Institute will be one of the basic components of the NIEP strategy for the future period.

International collaboration represents for NIEP a major priority materialized through politics and programs created according to the National Authority for Scientific Research strategy. NIEP has a long tradition in promoting national and international cooperation as a fundamental strategic objective of the institute. Examples of long-term cooperation: ICTP and University of Trieste, University of Karlsruhe, GeoForshungZentrum (GFZ) Potsdam, ETH Zürich, INGV Roma, CTBTO Vienna, IAEA Vienna, AFTAC (Air Force Technical Application Center) USA, University of Athens, Institute for Geophysics and Seismology in Chisinau, Institute of Geophysics in Sofia, NORSAR.

The strategic objective for increasing the research-development capacity and competitiveness inside NIEP has as main goal promoting "international integration". Action: Supporting Research-Development-Innovation projects developed on national level partnership oriented to the integration into representative international programs such as: FP7, ORIZONT2020, NATO, UNESCO, Stability Pact in Balkans area, bilateral cooperation, etc.

The specific objectives of the internal and external partnership strategy management contain activities from the following categories:

- Improvement of the competencies and the research potential at NIEP, by working-visits of scientific personalities and valuable researchers from Europe, Japan and USA;
- Participation to training sessions for the project proposals for European and international programs;
- Exchange of personnel, results and experience in science and technology related to Earth physics and connected domains;
- Initiation/training workshops;
- Framing into the EC programs, for instance GEO (Global Earth Observation), GMES (Global Monitoring for Environment and Security), GEOSS (Global Earth Observation of System and Systems), GEM (Global Earthquake Modelling), etc;
- Participation to the EPOS / ESFRI (European Strategy Forum on Research Infrastructure) platform. (www.epos-eu.org);
- Participation to the „Mediterranean European Rapid Earthquakes Data Information and Achieving Network" - CSEM/EMSC (European-Mediterranean Seismological Centre);
- Participation to the CTBTO monitoring system, UNESCO-IOC, AFTAC
- Participation to the "Atmospheric Dynamics Research Infrastructure in Europe" program (ARISE)
- NIEP will operate as a regional centre for South Eastern Europe in the European Seismic Network (VEBSN)