1. Project context and objectives

Introduction

"Research Potential – Plasma Potential – Shaping a European Research Centre for Plasma Technology" was the title of one of the most challenging international projects over the past years at Leibniz Institute of Plasma Science and Technology e.V. (INP Greifswald).
The main goal of the project was to support lifting up the INP to a higher European scientific level implying a better integration of the INP in the European Research Area and transforming our institute into a vehicle for regional, national and international development in the area of low-temperature plasma science and technology.
These ambitious goals were planned to be achieved by a set of measures in three main fields of actions strongly interacting with each other:

1. Recruitment, twinning and investment in equipment,
2. Improvement of the visibility of the institute and
3. Improvement of the Innovation Potential at the INP.

FROM IDEA TO PROTOTYPE – That is the motto of the Leibniz-Institute for Plasma Science and Technology. With its broad spectrum of applications for industry processes, the institute is Europe's largest non-university research facility for low temperature plasma physics. Since a few years, the institute is writing a success story, although being located in one of the less favoured convergence regions of eastern Germany. The institute's budget rose from 2 M€ in the year 2004 to more than 12 M€ in 2011, the number of personnel doubled during that period.

Beginning with the very basic knowledge and physical principles about plasma sources and their design, followed by the analysis of results of plasma interactions with its environment, iterative optimisation of the "desired effects", and construction of user friendly prototypes, the institute's knowledge about plasma technology is broad and deep to avoid focusing on a single and lonesome technique. Being aware of the importance of technology transfer, the institute developed a unique strategy to exploit research results effectively by the creation of spin-off companies. So far, three spin-off companies have been founded; at least 2-3 others are planned within the next years. In doing so, the institute's strategy covers the entire value chain, FROM IDEA TO PROTOTYPE.

The challenge

However, there were some difficulties the institute had to overcome. A comprehensive SWOT analysis revealed mainly two fields of weakness: the one is a lack of international co-operation, the other is a gap to the international state of the art knowledge of plasma generation, diagnostics, and modelling. Both weaknesses interact and prevent the institute from being recognised as an institute of the highest European scientific level of plasma physics and their applications.

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Therefore, the aim of this project was to turn the existing weaknesses and threats into opportunities and strengths and thereby guarantee a sustainable development of the institute's success not just for Europe, but also for the region and its economic development.

The opportunity

Innovation (i.e. productivity) seems to be the only way to go for European economies. The key to innovation is combining concepts from previously unrelated research fields. Such an approach is often named interdisciplinary or multidisciplinary and is nowadays the basis for successful and promising research fields. Such a multidisciplinary research field is plasma technology, which is in the centre of this project application.

Plasma technology unifies knowledge from various fields of science and industry like physics, chemistry and engineering. Thus, the multidisciplinary of plasma technology requires a multidisciplinary and international approach in plasma science, too. In prominent research fields e.g. regenerative medicine or sustainable environment protection, new solutions are required in the very near future and plasma technologies could play a key role here.

This will lead to new opportunities in plasma research on the one hand; on the other hand, new challenges have to be managed:

- Bringing together researchers from different research fields on an international level,
- Active participation on research funding programmes on the highest European level,
- Optimised research infrastructure where different research groups can work together,
- Interaction between basic plasma science and industry to sustainable transfer research results to products,
- Promoting communication of plasma technology applications to enhance the public interest and acceptance.

The project *PlasmaShape2012* addressed these challenges and aimed to enhance the awareness of plasma technology as a whole but especially of low temperature plasma physics in Europe. A study published by the National Academy of Sciences (USA) emphasises the complexity of low temperature plasma physics and the need to develop equivalent research programmes: "The many emerging applications of low-temperature plasma science are challenging and even outstripping fundamental understanding. "

Why now?

The overall strategy of the INP is to become one of the leading plasma science and technology centres in the world. There are a couple of reasons which let us to submit this proposal:
- Excellent research basis at the institute (infrastructure, scientists), but also a lack of specialists for basic plasma physics to achieve the necessary critical mass (to be competitive on an international level),
- Excellent research conditions in the region (universities in Greifswald and Rostock, further research institutes, business incubators), but also a need for more regional innovation capacities; a lack of industrial backbone,

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- Well developed networks but only few international researchers at the INP resp. the exchange with international researchers and institutions is not well developed yet.

One of the overall objectives of *PlasmaShape2012* was the better integration of the INP into the European Research Area. In order to achieve this goal, the INP analysed its weak points in a SWOT analysis. The results of this analysis let the INP to apply for this project to improve its science and technology infrastructure and long term international co-operations, and thereby increasing its participation in FP7. Additionally, it is crucial to attract research professionals by upgrading laboratory equipment and thereby increasing the visibility of the INP in the scientific community and especially for the high-tech economy.

Why INP?

The INP aims to carry out application-oriented basic research on the one hand side, while on the other hand it aims to optimise and further develop established plasma-assisted procedures and plasma products. The INP is capable of adapting plasmas to specific customer needs including services and consultations, completed by preliminary and feasibility studies. The INP launches research projects starting with the concept right through to building prototypes with market needs.

The direct correlation of experimental work and theory was successfully used in the field of plasma light sources. Meanwhile this unique selling point is used for the investigation of arc discharges for important applications such as switching, welding and cutting as well as surface treatment and plasma chemistry. A speciality of the INP is the modification of nano- and microdisperse materials (fibres, particulate matter) by means of non-thermal plasmas. Furthermore, the INP poses different techniques of surface analytic as well as biomedical methods.

The concentration of methods (plasma diagnostic, surface analytics, plasma simulation), plasma sources (from low to high pressure, cold to hot non-thermal) and experiences is unique in the world.

The INP looks back on an impressive success story demonstrating that the envisaged strategy is of proven quality and approbate for the next steps within *PlasmaShape2012*. For example, personnel could be raised by 50% (from 95 in 2004 to 185 in 2011) and the third party funding could be more than tripled over the last years.

The INP Greifswald is one of more than 87 non-university institutes of the Leibniz Association. While working strategically and oriented towards the subject, the Leibniz Association carries out research of interregional relevance which is important for the whole society. All institutes of the Leibniz Association employ about 16.800 co-workers (7.800 scientists) and have a total budget of approximately 1.4 billion €.

The Applicant and the Region

As described above, the INP carries out application-oriented basic research and optimises and further develops established plasma-assisted procedures and plasma products. The INP is situated in Greifswald, North-eastern Germany, at the Baltic Sea. One of Europe's oldest universities, founded in 1456, dominates the city (54.000 inhabitants, 12.000 students) and science has traditionally a basis here. Greifswald provides a large number of motivated and well trained students from many disciplines as Physics, Engineering, Medicine, etc. Plasma research in Greifswald does have strong roots due to a more than 6 decades lasting tradition, but lacks international co-operation. With about 500 plasma

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scientists and engineers, Europe's highest concentration of plasma specialists is located in this North-East German area.
There is a strong cooperation between the local university, the Max-Planck-Institute for Plasma Physics (IPP) and the INP as well as technology incubators on local level. Together with political authorities and stakeholders from industry, strong efforts were made to develop North-eastern Germany (Mecklenburg-Vorpommern) to an innovative region. Nevertheless, and compared to many other regions in Europe, Mecklenburg-Vorpommern is still economically underdeveloped and thus classified by the EU as a Convergence Region.

Perspective

An efficient integration of such a regional and national high-profile research, as the low temperature plasma technology research at the INP into the European Research Area, gives new impetus to the existing national and international research area and is able to influence the region's economic development on a sustainable basis. The institute could become a vital nucleus for both – new research results for the European scientific community and innovative technologies especially for SMEs.

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2. Main scientific and technical results and foregrounds

Work package 1 Management - Managing the project, Reporting and communicating to EC.

The objectives of this work package were to manage and coordinate the PlasmaShape2012 project, to maximize the interactive performance of the individual participants, to ensure the long-term goals of the project, and to manage contingencies in the case of problems and/or conflicts.

Based on the experience of managing projects, the INP has optimised the management tasks with focus on:
1. Ensure a smooth and efficient coordination and overall legal, contractual, IP, ethical, financial and administrative management of the project,
2. Optimise the achievement of planned objectives within the time schedule and allocated resources,
3. Meet deadlines for each work package,
4. Guarantee deliverables,
5. Provide the necessary financial management,
6. Organise boards and meetings,
7. Overview and optimise the dissemination and exploitation of results,
8. Oversee ethical and gender issues in the project,
9. Regularly update of SWOT – analysis and action plan,
10. Develop a plan to secure the sustainability of the projects measures.

An internal evaluation was carried out in month 19 to constitute the second project phase and was one topic at the 3rd Steering Committee meeting in December 2014. At the end of the project a concept was developed to ensure sustainability of the actions carried out during the project.

Summary of the Annual conclusions

The progress of PlasmaShape was summarized and explained in yearly annual conclusions. The document served as basis for the meetings of the projects Advisory Board.

PlasmaShape combined a set of measures implemented by six work packages representing the addressed fields of activity. These activities were investments in modern equipment (work package 2), promotion and exploitation activities (work package 3), twinning actions of experienced scientists (work package 4), recruitment of plasma physics specialists (work package 5), and measures for the innovation potential at the INP (work package 6). The interactive activities were coordinated by a project management (work package 1). Here, the activities within the project are summarized for each work package.

Work package 2 "Invest" dealt with upgrading and completing of the existing set-ups by procuring required equipment and was headed by Dr. Ronny Brandenburg. All equipment planned to upgrade the existing setups to a high level of expertise is procured and in operation. They are implemented in the research projects currently running and deliver results. Work package 2 "Invest" was completed in project month 12.
The Advisory Board recommended that the INP should secure the sustainable use of all equipment.

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Work package 3 "Promotion" conducted measures as pointed out in the periodic marketing strategy plan. This work package was headed by Dr. Christine Pöhlke. The activities were assigned to three main fields of action: widening network activities, attracting excellent researchers and fostering/expanding scientific excellence.
The Advisory Board recommended that the marketing strategy plan needs to be continuously developed and its direct and indirect measures should be continued and intensified. In particular, they suggested to include on the projects website news roll not only **short notes on papers written** by the recruited scientists but all joint publications written with the support of PlasmaShape. Furthermore, the Advisory Board supported the plan to commission a **bibliometric analysis** as visibility test for a scientific institute to set the basis for monitoring the long-term impact of the project PlasmaShape. The board also suggested commissioning a further bibliometric analysis in January 2019 in the follow-up to the PlasmaShape project to monitor the full impact. The event "**Future in Plasma Science**" which took place in July 2015 and February 2016 were greatly expected by the board members. Most of them joined the event and they were very excited about the outcome of this new type of event and the modern formats during the event.

Work package 4 "Twinning" focussed on strengthening cooperation between the INP and European and international research institutes. Therefore, twinning activities within the PlasmaShape project were essential. The work package was headed by Alexander Schwock, who supported and analysed visiting researchers from partner institutes and in-house scientists visiting cooperative partners. The number of guests visiting the INP was at a high level.
The Advisory Board recommended that twinning activities of the in-house scientists should be intensified. The INP should provide conditions especially for the heads of Research Programmes and Scientific Departments to perform twinning activities.

Work package 5 "Recruitment" had its focus on employment of international experienced scientists. Within the first 18 project months six scientists were employed.
The Advisory Board recommended checking until November 2014, which existing contracts should be extended or if an additional scientist should be employed. As a result of the discussions with the heads of Research Programmes all employed scientists will stay at the INP.
In regard to the performance and scientific output the Advisory Board concluded that the recruited candidates perform very well in writing papers and attending conferences. Furthermore, applications for several project proposals were submitted and the Advisory Board recommended supporting the scientists in equal measure to maintain their excellent performance. The Advisory Board concluded that the work package was finished successfully in project month 24 and asked for a regular update on the performance also in regard to joint publications.

Work package 6 "Innovation" was designed to secure the innovation potential at the INP. The IP analysis was performed. Furthermore, the IP strategy was developed and comprises the set-up of organizational structures and specified processes, a custom-tailored installation of a professional patent and contract data management software was also finalised. A strategic consultation of the heads of the research programmes by professional patent lawyers took place. The process and respective regulations in house for inventor's bonus was set-up, the respective payment-out have been

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carried out. The finally employed IP manager Mrs. Dörte Valenthin received the offer for a permanent position after the project duration, which she accepted. By doing so one of the main results of the PlasmaShape project was fulfilled: The innovation potential and its management is secured.
The Advisory Board recommended that the INP implements the measures pointed out in the IP strategy. The core of this action was a custom-tailored installation of a professional patent and contract data management software. Furthermore, the Advisory Board recommended that the INP continues to follow up on the strategic research programs patent meeting.

The Advisory Board notified that the project was in line with the work plan and prompted the project team to accelerate considerations for sustainability actions. An extended discussion on possible project topics in line with the Horizon 2020 strategy took place. Project partners plan to apply together with the INP for calls within the Marie-Sklodowska-Curie actions (International Training Networks, Individual Fellowships) and the topic “Spreading excellence and widening participation” (TEAMING, TWINNING). Also calls from the funding topics within “Societal Challenges” were of high interest.

Up-dated SWOT analysis

In the second project period the activities addressed the weaknesses and threats described by the SWOT analysis as explained in the proposal/DoW. The SWOT analysis was updated finally: There was no recognizable need for a fundamental change of the action plan.

List of project meetings, dates and venues

The PlasmaShape project was structured with regular meetings of all project committees. The Management Board consisting of the project coordinator and the leaders of the work packages met bi-weekly to discuss and present the process of their work packages. The Steering Committee as the strategic decision-making body of the project met bi-annually at the partnering organisations. Here, reports from the Management Board were presented and discussed. The projects’ Advisory Board consists of representatives from scientific and political stakeholders and met every year not only to overview the project progress but also to discuss topics and activities beyond the project.

The meetings of the Steering Committee and Advisory Board during the project were:

Management Board meeting - from June 2013 until May 2014, bi-weekly on Monday at 1:30 pm. From June 2014 until the end of project, weekly on Thursday, 3 pm. at INP,

Kick-off meeting - 20 June 2013 at Leibniz Institute for Plasma Science and Technology, Greifswald,

1. Steering Committee meeting - 27 November 2013 at West Pomeranian University of Technology, Szczecin, Poland,

2. Steering Committee meeting and 1. Advisory Board meeting - 17 – 18 June 2014 at St. Petersburg State University, St. Petersburg, Russia,

3. Steering Committee meeting - 11 – 12 December 2014 at Université Toulouse, Paul Sabatier, Toulouse, France,

4. Steering Committee meeting and 2. Advisory Board meeting - 20 – 21 May 2015 at Masaryk University Brno, Czech Republic,

5. Steering Committee meeting - 11 – 12 November 2015 at University of Bari, Italy,

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6. Steering Committee meeting and 3. Advisory Board meeting - 17 – 18 June 2016 at EMPA, St Gallen, Switzerland.

Work package 2 Investment - Upgrading and development of research equipment

During the design of the proposal the project manager performed a survey amongst all heads of the different Research Programmes whether there is a need for improvement of the equipment. The feedback was collected and together with the Director of the INP rated in terms of research direction, multi-usability, and price. The resulted ranking list was then returned to the heads of the Research Programmes for justification, why the chosen equipment could contribute to integrate the INP into the European Research Area. A final rating list of all these information was performed by the director and finally included in the proposal. The finally purchased equipment (and the already existing one) was the basis for the scientific success of the project. As pointed out in the sustainability concept, the responsibility for maintenance of the devices lies with the heads of departments. Respective funds have been allocated to the departments. In that way the continued operation of the devices is secured for the future.

Test Certificates of the Equipment

All equipment planned to upgrade the existing setups to a high level of expertise was procured and is in operation. They are implemented in the research projects currently running and numerous scientific results are obtained during experiments. Test certificates of all procured equipment were prepared and include:

Mobile TC-SPC system (incl. spectrograph): One of the aims of the project PlasmaShape was to strengthen the opportunities and visibility of the INP Greifswald in the field of plasma diagnostics. Within the last few years a novel method for the study of transient gas discharges was established at INP: time-correlated single-photon counting (TC-SPC). many potential European cooperation partners are very interested in its application on their plasma sources but hesitated because of the complexity of the method. By offering the TC-SPC application to our European cooperation partners the INP gains more visibility in the field of plasma diagnostics and could attract the interest of other European research institutions to establish future collaboration.

PC system for simulation software and software license: Another aim of the project PlasmaShape was to strengthen the opportunities and visibility of the INP Greifswald in the field of plasma simulation. To perform novel simulation work on non-thermal plasmas the extension of the hardware system at INP and the procurement of simulation software were necessary. The new established hard- and software is extensively used for the modelling of plasmas at atmospheric pressure e.g. plasma jets.

STEM detector: The investigation of nano-structured materials is one of the crucial tasks of surface analytics at INP. In this context, the continuous extension and improvement of equipment for surface analytics play a strategic role. The new JEOL STEM detector allows investigating thin films in the first phase of their growth, the so called nucleation. The diagnostics of nucleation at a high morphological resolution is required and it can be provided with the STEM detector up to 0.8 nm at an acceleration voltage of 30 kV. Moreover, typical tasks for scanning transmission electron microscopy can be solved, too, e.g. the microscopy of nanoparticles and powders.

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Fast IR camera system: In addition to the mobile TC-SPC a new IR-camera was considered to strengthen the opportunities and visibility of the INP Greifswald in the field of plasma diagnostics. Such a camera system enables investigation of heat transport processes in gases at high speed frame rate up to several kHz as well quantitative monitoring of surface temperatures at a high spatial resolution.

Ultramicrotome: The INP aims to become a leader in the field of deposition of micro- and nanostructures with reactive gas discharges. This required an extension of equipment for innovative surface analytics. Particularly scanning electron microscopy (SEM) offers great possibilities of structure imaging. However, the success of modern SEM approaches is based on a sophisticated and highly precise sample preparation. The ultramicrotome is a powerful preparation technique for SEM based on fine mechanical sectioning. It enhances the capabilities of INP in surface analysis and SEM significantly and is in close methodical relationship with the STEM detector.

Work package 3 Promotion

Even while designing the project outline it was obvious to us that the institutes' visibility is not sufficient. Thus, we started at a very early point to discuss whether classical promotional instruments like leaflets and conference organisation would be enough to reach the stated aims for our project. Soon we realized that innovative elements were essential for successful marketing activities in the sense of PlasmaShape. They ranged from sophisticated give-aways to revised event concepts merging classical and modern formats up to small details like INP stickers used initially to label lunch-to-go-bags during events but now became also a tag for magazines including articles about research work at the INP. All these activities were extremely effective and leave such a permanent impression that also external guests gave us a positive feedback, which is the core of promotional activities. These activities will be further pursued like it is described in the sustainability concept.
The tasks within this work package covered:
1. Dissemination of results to industry,
2. Dissemination of information to governmental and non-governmental organisations,
3. Spreading information to the international plasma community,
4. Distributing information to the society,
5. Exploitation of market-ready developments,
6. Organisation of workshops and conferences.

Summary of the periodic marketing strategy plan and update
For the PlasmaShape project a comprehensive analysis of strengths, weaknesses, opportunities and threats (SWOT analysis) was conducted. We considered focal points of the SWOT analysis with potential improvements for a strategic marketing, which were

1. Bringing together scientists from different research fields on an international level,
2. Optimizing research infrastructure,
3. Promoting communication of plasma technology applications to enhance public interest and acceptance.

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Three fields of work derive from these challenges: broadening the existing network, attracting researchers and fostering scientific excellence. With these three fields of work numerous activities were defined to be addressed in the following project months. Addressed marketing activities were:

a. For strengthening networks activities:
   - Target group orientated and bilingual information material,
   - New concepts for workshops,
   - Information pages in international network platforms like Xing or LinkedIn.

b. For becoming an attractive employer:
   - A mission statement of the institute,
   - Evaluation of the effect and acceptance of award systems,
   - Encouraging the scientists to publish articles outside the scope of their projects,
   - Application for the Total E-Quality certificate,
   - Process of anonymized applications.

c. For fostering scientific excellence:
   - Publication of INP articles announced on social media sites (LinkedIn, Xing),
   - Setting up a special post-doc program of up to three scientists.

For strengthening networks activities our core actions were (i) an intensified communication via websites and business-oriented social networking services, (ii) new concepts for meetings and workshops to bring together scientists of all levels of experience and different research areas and (iii) target group orientated and bilingual (English and German) information presenting the performance of the INP in order to reach stakeholders and potential cooperation partners from different disciplines.

With **business-oriented social networking services** we aim to maintain contact or to establish contacts to researchers and potential cooperation partners. We chose LinkedIn and XING as suitable platforms to install company sites of the INP. On both websites the company's page was updated with photos and news on a regular basis. These pages gained much interest since they have been activated. At LinkedIn we increased the number of followers from 11 to 140. On XING the number of followers increased also from 6 to 25. Also we were able to bundle the scattered appearances of our institute on these social networking service sites resulting in a uniform online presence.

In addition, the **project website** was upgraded regarding its content and information made available. To strengthen the identification of the INP Greifswald with the PlasmaShape project visible vie the websites we decided to:

(i) Create a new internet address of the PlasmaShape project including INP and the projects' name: www.inp-plasmashape.eu,

(ii) Design the project website very similar to the INP website's design,

(iii) Skip the logo of PlasmaShape, because there is no benefit for the INP to have a PlasmaShape logo without a "connection" to the INP, which is similar to the EC decision not to have a Horizon 2020 Logo.

An analysis of all cooperation partners, joined networks and organizations in which the INP is involved, served as basis for an interactive map on the projects website.

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The **board meetings** for Steering Committee and Advisory Board were extended from a solely administrative meeting to a scientific and reporting workshop, combining scientific round tables with administrative topics gaining higher visibility, strengthening cooperation and adding new scientific approaches and increasing the attractiveness of such meetings for board members.

In addition, we intended to arrange an event bringing together established senior scientists and young researchers as described in our periodic marketing strategy plan. Therefore, we drafted a concept for an event to bring together researchers with expertise in these fields to develop new strategic areas in plasma science by discussing future issues of plasma science and designing common projects ideas: **Future in Plasma Science**. The event took place from July 12 to 15, 2015 in Greifswald following the 22nd International Symposium on Plasma Chemistry in Antwerp, Belgium (ISPC22). The event "Future in Plasma Science" was successfully conducted and was continued on February 15 to 18, 2016. The feedback from the participants revealed a strengthening of the INP network and the initiation of new cooperation.

We planned to design **illustrating marketing material** for partner institutes, network partners and possible cooperation partners to put scientific work within the manifold projects at INP in a main focus. Our intensive activities on our project website and with business-oriented social networking services revealed that communicating via social media is faster and more effective. So we decided to cancel the realization of illustrated marketing material.

Together with the local Chamber for Industry and Commerce Neubrandenburg we developed the idea of enhancing the INP's **regional network activities** in inviting industrial networks to have their regular meetings at the INP in order to get more familiar with INP research and technology transfer activities. These activities were planned in close cooperation with the local Chamber for Industry and Commerce Neubrandenburg, BioConValley (BioTech Cluster), and the BalticNet-PlasmaTec (International Plasma Technology Cluster). We experienced that inviting business-related networks is the most effective way of presenting the institutes activities to regional and trans-regional industrial player. During the last phase of the project three network meetings took place.

The analysis of all **cooperation** of the INP with national and international partners was changed to a sound basis counting contractual cooperation instead of cooperation without any contract as done before. The number of durable cooperation significantly increased from 2014 to 2015:

- from seven to 21 universities,
- from four to eight non-university research organisations, and
- from six to twelve companies.

In particular, the increase of international cooperation is remarkable, although this trend cannot solely be originated by the project's activities. Obviously there was no need for a substantial change of the strategy in regard of the cooperation activities.

In the second period of the PlasmaShape project we realized our concept for an innovative workshop called **Future in Plasma Science**, which is a strategically viable addition to the extended board meeting. Both forums offered a platform for targeted networking and led to new cooperation in the sense of new and innovative project ideas resulting in new interdisciplinary fields of research.

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These actions were accompanied by an intensified activity on website and social media sites to visualize our ideas and approaches but also offering useful information to facilitate building scientific networks and cooperation.

For becoming an attractive employer we planned as core actions (i) to develop a mission statement of the institute to strengthen the identification of the employees with the INP, (ii) to evaluate the effect and acceptance of award systems like the internal paper award and performance-related remuneration and, if necessary, revised, (iii) to encourage the scientists to publish articles outside the scope of their projects and (iv) to give a strong signal for possible candidates that the INP is an open-minded and future-oriented institution by the successful application for the Total E-Quality certificate and the process of anonymized applications to be implemented.

The development of the **mission statement** of the INP was a long-term process in close discussion with all employees of the institute. The mission statement was drafted and discussed in a group of institute members from different levels and work areas representing the INP. The mission statement was finalized in April 2014 and is available on the institutes website.

The INP was supported by the project team for their application for the **Total E-Quality certificate** in May 2014. The successful application for the Total E-Quality certificate illustrates that the INP is very involved in creating equal opportunities and a family-friendly environment for its employees. Furthermore, the label is a strong signal to possible candidates that the INP offers much more than excellent science.

In addition to the awarded Total E-Quality certificate we supported the personnel department with implementing the **anonymized application procedure**. Since June 2014 this application procedure is used for the selection process of all open positions. The anonymized application procedure ensures equal opportunities for all candidates in the first steps of the decision process.

In close cooperation with the personnel department we decided to draft a bilingual **career portal** to provide more information to job candidates about the INP as an employer in general, illustrating the working environment at our institute as well as further information about “Living in Greifswald”. A catalogue of frequently asked questions and helpful hints was collected for the possible job candidates. By the end of 2016 the institute will introduce professional and forward-looking software for the management of knowledge and data in general. This software will replace the existing data handling system, the mail system, and the internal databases. Introduced will be a special intranet communication system and, connected to this, a system for programming of the institutes website. Because of this, further development of a career portal is postponed until the introduction of the new knowledge management system in 2016.

At present the INP offers two internal award systems: a **performance-related remuneration** and an internal paper award. The effect and the acceptance of both award systems requires an evaluation and, if necessary, a revision. Introduced in 2012, performance-related remuneration at the INP was an individualized tool based on agreed targets defined in the annual personnel evaluation and the targets of the department and Research Division. The feedback of works council, gender equality officer and board of directors regarding the performance-related remuneration of the employees was gathered

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in mid of 2015 for an evaluation and showed that it was too complicated; the simplified version was released in May 2016.

The internal **INP research award** was developed two years ago as a tool to honour and motivate the researchers for their paper writing activities. Each year an established senior scientist and a young researcher are awarded and could choose their award from a catalogue ranging from assumption of costs for special workshops, sabbaticals or conferences. The award has not yet been fully recognized and therefore measures should be taken to intensify its visibility – an in-house hall of fame will be developed by end of 2016.

The analysis of all **received applications** showed that the number of applications ranged on a high level throughout the second project period. One third of all received applications were of international candidates with a slight increase in favour of national applications, which was due to a high number of job offers in our institutes' administration. The data also reveals an increase in the relative number of speculative applications in 2015.

For fostering scientific excellence by stimulating the scientific publishing process with support and optimizing processes and by cooperating with the renowned institutes worldwide to raise the awareness of published articles by the INP is notified. The core actions were (i) to announce scientific articles in high impact journals in **regular press releases** in European magazines and on social media sites in order to reach a wider scientific audience and (ii) to set up a special **post-doc program** of up to three scientists to define possible new fields of research connected to plasma science and technology to allow the opportunity to conduct cutting-edge research.

With writing and issuing articles summarizing and simplifying scientific publications in **regular press releases** we aim to present research results gained at the INP to a wider scientific audience. These articles were released at the scientific information service IDW – Informationsdienst Wissenschaft, but also at the company's sites at the business-oriented social networking services and the website of the INP.

In the first period of the project we focussed our activities on introducing the recruited scientists within PlasmaShape and their fields of research. The scientists and their scientific topics as well as their fields of work were shortly described on the revised project website. Following the event "Future in Plasma Science" the local newspaper "Ostseezeitung" released an article about the sense and the outcome of the event. A special press release was issued in our internal newspaper at the end of the project to explain to the wider public the results and the benefit of the project.

A special **post-doc program** of up to three scientists was set up to define possible new fields of research connected to plasma science and technology and to allow the opportunity to conduct cutting-edge research. The scope of the planned project is spanned for a period of up to five years. The proposed project concepts should cover a scientific area, which fits to current INP activities or is an added value to it. For setting up the special post-doc group program, candidates were invited to submit their project ideas for a duration of five years, which have been later on rated by the INPs' Scientific Advisory Council. The program and the idea as well as the chosen candidate (researcher in the field of atmospheric low temperature plasma surface treatment for industrial use) were announced in May 2016, starting point will be January 2017.

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In addition, a **scientific writing workshop** for young scientists was offered for raising their skills in writing high-ranked scientific publications, the workshop was held by an experienced senior scientist and professor for plasma physics – Prof. Raymond Boxman.
Rounding that up a **bibliometric analysis** was commissioned for monitoring published articles by the INP scientists. The bibliometric analysis was finalised in January 2016 and gathered data contains vital information regarding the visibility of the institute within the scientific plasma physics community and will be an adequate substitute for a visibility check. It covers the time ahead and the first year of PlasmaShape. In 2017 a further bibliometric analysis is planned to identify the impact of scientific project activities.

Regional exhibition – Open Day 2013

Within the Open day we offered guided lab tours each for about an hour through the laboratories for high voltage, welding arcs, microbiology, bioelectrics and pollution degradation displaying the wide range of the INP research. The high number of visitors was split into groups for joining the guided lab tours. Every group was leaded by a scout and visited different research foci. The event was issued in local newspapers like “Nordkurier”, “Ostseezeitung”, and local advertising newspapers like “Anzeigenkurier” at November 15, 2013 as well as local and regional calendars of events. We welcomed 120 guests from Greifswald and the local area, and we could show our laboratories to nine groups, which followed our tours with a great deal of interest.

Organisation and documentation of HAKONE 2014

The 14th International Symposium on High Pressure Low Temperature Plasma Chemistry (HAKONE XIV) was held in Zinnowitz/Germany September 21 to 26, 2014. HAKONE XIV was jointly organized by the Institute of Physics (IfP) at the University of Greifswald and the Leibniz Institute for Plasma Science and Technology (INP Greifswald). The bi-annual symposium brings together scientists and engineers working on subjects in the basic research and plasma processing of high pressure and low temperature plasma chemistry. 154 regular attendees and 15 accompanying persons and guests from 21 different countries participated at HAKONE XIV, which provided a forum for sharing knowledge, experience and creative ideas in an informal atmosphere. In particular, the next generation of researchers could meet with leading scientists in their field in a familiar atmosphere. 37 participants were students or PhD-students. The program included invited lectures, oral presentations and poster sessions. There were no parallel sessions and sufficient time was available for informal discussions.
Five invited lectures were selected by the International Committee of the conference HAKONE. In addition, 46 oral presentations were given and 88 posters were discussed in 3 poster sessions.

Regional exhibition – 2016

For raising the visibility for our institute and its abilities to support SMEs in finding solutions for technological challenges we stay in close contact to our regional Chamber of Industry and Commerce. Also we figured that inviting network initiatives of regional SMEs to visit the INP Greifswald for their annual meetings is extremely beneficial for establishing a broad network among those partners and

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the INPs scientists. These invitations are always arranged together with laboratory tours to show and explain the capabilities plasma technology can offer to industrial applications.
One of those described regional networks is the Hydrogen Technology Initiative (WTI MV - Wasserstofftechnologie-Initiative Mecklenburg-Vorpommern). The initiative works closely together with the Research Programme Materials/Surfaces of the INP Greifswald in order to develop new catalysts meeting the needs for the renewable energy sector. Their annual meeting was organised at INP Greifswald and was scheduled for May 31th 2016.
To represent the INP Greifswald more comprehensive in a more time-efficient way, we staged an exhibition in the entrance foyer of the institute beside the laboratory tour and the network meeting. The spacious entrance foyer at the ground floor offers enough room for scientific exhibits and glass cabinets, and during working hours it is also accessible for wider public.
The glass cabinets we used to display loans from all our Research Programmes illustrating the research foci at the INP Greifswald and giving insights to our diversified research portfolio within plasma science. All exhibits were accompanied by a short, commonly understandable explanation card.
The exhibition was designed as permanent exhibition in the entrance foyer to present a professionally working institute on the long-term. Thus we enhance the institutes visibility by showing in a comprehensive and generally intelligible way the diverse range of plasma science and technology. But also it allows scientists, industrial partners and political stakeholders to gain deeper understanding of our daily research work.
In addition, the activities for staging the exhibition raised the awareness among the in-house scientists towards a professional presentation of their work including recent exhibits and their visibility for wider public.

Organisation and documentation of "Future in Plasma Science I and II"

With the events "Future in Plasma Science" in July 2015 and February 2016 we aim to establish a strong and broad network of cooperation partners with emphasis on international institutions of highest scientific level and different scientific disciplines as that is one of the main aims of the projects' marketing strategy for improving the visibility of the institute. The activities considered to strengthen our networks aim at a reviving of dormant networks and to enhance new network activities encompass developing new concepts for meetings and workshops to bring together scientists of all levels of experience and different research areas.
An important issue when facing challenges in plasma physics is the interaction between the areas of plasma sources, plasma diagnostics and plasma modelling. Therefore, we drafted a concept for an event that would not only tackle the issue of parallel areas of plasma physics but would also address experienced senior scientists and junior researchers. We aimed to generate an open atmosphere to figure overlaps and gaps within the different fields of plasma research and develop new strategic areas in plasma science. By doing so we wanted to offer a platform to refresh contacts and establish new ones.
A tangible result was the start of a **consensus paper** on the importance of plasma science and technology in 2030. This paper will be a consensus of the entire plasma science community developed by the concerning scientific community and will serve as a strategic paper to be presented to funding

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authorities, and more likely to future cooperation partners from industry. The consensus paper will depict the possibilities plasma science can offer to address future and emerging challenges.
The second part of the workshop was dedicated to work on **theme-specific white papers** underpinning the consensus paper and showing in more detail the scientific challenges plasma research will face in the next decades.
These events were also an appropriate occasion to present the INP, its research and the connected equipment on an international level within the plasma science community. Our expectations for the events were threefold: first of all, we aimed at an identification of promising research areas and open questions within plasma science. Second, with this we aimed at initiating scientific discussion between eminent scientists and junior researchers to establish co-operations with strategic partners and that would eventually result in new projects. Overall the outcome of the workshops would also help our institute to evaluate and review the strategic orientation. The target group therefore was as mentioned before predominantly experienced senior scientists and junior researchers from the areas of plasma sources, plasma diagnostics and plasma modelling. This applied to external and internal researchers.
In consultation with our heads of the research programmes and scientific departments and the institutes' director we developed a customized and **modern format of a workshop**. The design of the event had its main focus on a merging of modern ideas with classic elements of scientific conferences. By doing so we spanned the entire range of possibilities to create an inspiring environment for discussing future issues of plasma science and designing common projects ideas. With that modern format we invited internationally renowned senior scientists from the respective research fields and we found an extremely positive response including offers of support.
We identified six topics to structure the events in order to cover all essential fields of plasma science and to prepare grounds for the discussion on future developments in those topics on the background of the researcher's scientific background.
The topics were:

1. Energy & IT
2. Optics & Glass
3. Medicine & Biomedicine
4. Aerospace & Automotive
5. Plastics & Textiles
6. Environment & Hygiene

Starting point was short lectures to ignite the discussion in the respective topics and fields of research. An introductive session covered the fundamentals underlying plasma science. We associated six of the invited speakers giving a keynote lecture in their respective field. Furthermore, we invited all addressees to announce their potential contribution to the scientific session, which could be an interactive lecture or a statement, as well as chairing one of the topics. Also we invited both the external and internal senior scientists to recommend junior researchers, who were later on contacted and invited by the organising committee.
For the events the **name tag** served as a pass for all activities over the next workshop days.
A **welcome reception** with all invited speakers, external junior researchers and the internal guests was used to give more detailed information about the agenda of the following days to the attendees and

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briefed the chair persons to clarify on the uncertainties due to the new type of workshop format, and the expected outcome by the director of the institute and the project manager.

Scientific sessions started with keynote lectures building a good basis for the following discussion. At the end of the workshops summaries of scientific sessions took place and began with short structured summaries of both scientific sessions by the chairing persons of the respective topic. A modern tool to document the discussions during the scientific sessions was a graphical illustrator whose task was to "draw" in an easy and understandable way the thematic discussions of the scientists. As a result, a picture of the discussed topics combined with key questions and key statements was presented to the audience at the end of the workshop.

Another format of a scientific session was used to introduce the junior scientists and their research topic: **Scientific pitches**. Junior scientists presented their studies and recent work in a short three-minutes-long scientific pitch.

The junior scientists also had the chance to present their work in more detail in a mixed classical-modern format during a so-called **poster lunch**. Here the junior scientists could present their research in a relaxed atmosphere.

Change of location was a powerful tool during the three-day-long workshops. The several changes of location were done with the intention to mix up the group.

Networking dinners: our dinners were always designed as a networking evening in a cosy surrounding with the opportunity to discuss in smaller groups and to mingle with the group to join different activities.

Live experiments and lab tour gave all attendees the opportunity to either meet for a personal discussion with potential cooperation partners within the INP or to join a guided tour through six exemplary laboratories representing both Research Divisions of the INP.

Instead of a standard laboratory tour we designed the so-called "**Open Lab**" during the second workshop. In advance to the event we offered the participants to identify special laboratories of the INP they would like to visit.

A further modern format was introduced during the second workshop closely connected to the Open-Lab-Format: **Match making**. That was planned to give especially younger scientists the chance to meet senior scientists with sufficient time for a face-to-face discussion.

A **free-your-mind-session** at the first workshop was tested. A talk by a neurologist (Prof. Dr. Martin Lotze, University Medicine Greifswald) gave insights on his research on the human brain and learning behaviours.

Conference dinner was one classical activity we used for completing the workshops. Beside a vivid discussion on future plans for projects and joint publications we awarded the best scientific pitch and the best poster with the **PlasmaShape Junior Research Award**.

Press briefing: We invited the local news to join the final discussions and to report on the international meeting for future in plasma science. The local newspaper "Ostsee-Zeitung" interviewed some of the participants and the institutes' director resulting in an article the next day.

Lunch-to-go was prepared for all participants to end both the event and to provide them with a lunch for their journey back home. The lunch-to-go was equipped with INP-labelled lunch bags and branded coffee mugs.

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The **analysis of the feedback survey** revealed an extremely positive feedback of the participants attending the event Future in Plasma Science, in particular the fruitful discussions due to a mixed audience of senior and junior scientists, the change of location associated with the change of the discussion partners and the mixture of classical with modern elements during the workshop was well-received. It is planned to have a "**Future in Plasma Science III**" event in combination with the IEEE International Conference on Plasma Science (ICOPS) at Atlantic City, USA, in 2017. The participants have been already informed about the future event.

Work package 4 Twinning - Exchange of know-how and experience by secondments

At the very beginning of the project it turned out, that the planned twinning activities could be extended. This led to the relatively high number of visits (twinning activities) to and from the INP. It turned out that these visits have been tremendously beneficial for the INP, but also for the visiting scientists. One could state, that never before there was so many exchange between scientists of INP and partner organisations. This resulted in a great number of new cooperation, new research directions, and new research project proposals. Therefore, the INP decided in the frame of the sustainability concept to continue with these kind of exchange visits, but unfortunately, due to limited resources, in a reduced way and will apply in the future more actively for exchange programmes. Exchange of scientists is the crucial basis for successful science and technological development.

Incoming twinning partners and the first analysis of added value

Originally it was planned to welcome 14 foreign scientists several times in the INP during the project lifetime. To optimise the fulfilment of the work package objective and to strengthen strategic partnerships between the institutes in the different research departments the twinning activities were expand to all scientific departments of the institute. Until the end of the project 61 international recognised scientists visited and worked in our institute.

Together with the inviting scientists, who also acted as a supervisor for the visiting scientist, the twinning team prepared the visits at the INP. All visiting scientists were requested to introduce themselves, their institutions and scientific work by a lecture to other researchers. By this also additional cross-cooperation were initiated. To analyse the scientific benefit for the INP and to collect data for the evaluation, the supervisor of each visit was obliged to prepare a visit report and explaining the main effects of the visit.

Outgoing twinning partners including analysis of added value

To get introduced to other research institutions, especially their scientific focus, their specialisation and to identify complementary technologies and analytics, experienced scientist from INP should visit partner institutions. Originally it was planned to send 5 scientists to different institutions. To realise a broader exchange this measure was opened to all experienced scientist of the Leibniz Institute for Plasma Science and Technology. Visits of 34 scientists at 50 different institutions took place. The long term twinning of Dr. Brandenburg was realised before the PlasmaShape project started by internal funds. During the preparation of the visits it turned out that most of the visits last 1 week not to interrupt the ongoing scientific work in the INP. It turned out that the organisation of long term visits

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is far more difficult. Especially the younger experienced scientists have family commitments, which have to be taken into account.

Highlights of these visits in institutions abroad were:

- The start of a joint work of the Research Programme Decontamination with the group of Prof. Ion Sava from Iasi, Romania, on polyimide films – structural modification by plasma in liquids. Targeted industry is within the area of microelectronics,
- Also in the Research Programme Decontamination a cooperation with another group from Iasi, Romania, Prof. Popescu, is in the area of bioelectrics by installing a 100 ns pulse generator,
- In the area of plasma medicine, a strong cooperation with the group of Prof. Choi, Seoul, Korea, was established and led to a common proposal for a several million Euro project granted by the Government of Korea (GRDC proposal),
- For the same Research Programme Plasma Medicine, a strategic cooperation with the group of Prof. Hori from Nagoya, Japan, in the area of cold plasma medical applications was initiated,
- Based on the very young area of nanomaterials synthesis in liquids by plasma the Research Programme Decontamination was able to start common investigations with the group of Prof. Saito from Nagoya, Japan.

These highlights demonstrate that not only cooperation in Europe have been started or even tightened, but also new cooperation abroad have been initiated by the possibilities the PlasmaShape project offered to the scientists at INP and their partners. To report the results of their visits, outgoing scientists prepared travel reports to demonstrate the benefit of the visit.
It is worth to mention, that visits from INP scientists to partners worldwide were nearly equally distributed all over the six different Research Programmes. Depending on the target markets of the different Research Programmes topics, slight deviation does occur. For example, the Research Programme Decontamination had 19 visits during the project activities (strong internationally oriented because of relatively young research topics), the Research Programme Bioactive Surfaces had 7 visits to other partners (topics oriented mainly towards national industry).
Regarding incoming visits the distribution over the different research programmes is more inhomogeneous, e.g. similar to above: 5 visits took place to the Research Programme Bioactive Surfaces, but 36 visits were assigned to topics from the Research Programme Decontamination.
The number of incoming and outgoing scientists for each of the Research Programmes were in detail:
Research Programme Materials & Surfaces: 21 incoming visits and 10 outgoing visits,
Research Programme Process monitoring: 11 incoming visits and 10 outgoing visits,
Research Programme Welding & Switching: 19 incoming visits and 9 outgoing visits,
Research Programme Bioactive Surfaces: 5 incoming visits and 7 outgoing visits,
Research Programme Plasma Medicine: 5 incoming visits and 12 outgoing visits,
Research Programme Decontamination: 36 incoming visits and 19 outgoing visits.

The heads of the research programmes are obliged to continue with initiating and maintaining their international contacts supported by measures indicated in the sustainability concept, e.g. participating at the so called “INP-Tour”. This tour will take place twice a year to selected institutions to initiate

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strategic partnerships in Europe and abroad. This activity will be funded by internal funds which are reserved for especially this aim.

Work package 5 Recruitment - Recruitment of experienced researchers

The overall concept of the work package 5 - Recruitment was to hire specialists to reinforce the research activities of different Research Programmes. From the proposal submission until the start of the project some of the originally planned employment of researchers haven't been available anymore, and we decided to, in agreement with the project officer, to announce open positions without any specification of desired experience or qualification. Several dozens of applications of different quality had arrived. The project manager together with the heads of the different Research Programmes and the director selected suitable candidates out of all applications. To support the INP in general, and the thematic areas mentioned in the proposal/DoW, candidates have been invited for a personal interview or a remote interview via video conference. Doing so took care to select candidates supporting as many research programmes as possible (to avoid to have too many hired researcher for a too little number of Research Programmes). As described above, the finally hired candidates have been of high benefit not just for the INP and the PlasmaShape project, but also for the candidates itself. As the end of the project came closer, the heads of the Research Programmes performed interviews with the hired scientists, whether they would like to stay at INP, or if they want to continue their careers elsewhere. As a result, three scientists will stay at INP, whereas three others will leave for other positions.

Since July 2013 the Research Programme “Bioelectrics” was strengthened with the expertise of a specialist on measurements of bactericidal radicals generated by corona discharges in liquids and on the synthesis of nanomaterials in liquids by plasma. A scientist focussed on interaction of surfaces and plasma also in regard to medical applications worked in the Research Programme “Bioactive Surfaces” to improve polymer surfaces with plasma since October 2013. A plasma chemist trained in Padua, Italy and Tsukuba, Japan focussed on plasma-chemical degradation of volatile organic compounds in the Research Programme “Pollutant Degradation” since October 2013. In addition, a plasma physicist also worked in the Research Programme “Pollutant Degradation” since January 2014. He focussed on diagnostics of the filamentary gas discharges with using time-correlated single photon counting (TC-SPC). He obtained his PhD from Gent University, Belgium and he is specialized in optical emission spectroscopy in Texas A&M University at Corpus Christi, USA. From July 2014 a plasma physicist specialized in modelling and simulating of switching arcs supported the Research Programme “Welding / Switching”. From August 2014 until November 2014 a scientist specialized in surface layers worked in the Research Program “Surfaces / Thin films” to improve plasma-based chemical deposition processes and thin film deposition. From March 2015 a further plasma scientist started his work within the Research Programme “Surfaces / Thin films”. With his expertise in copper surface treatment he strengthened the research activities for plasma-based treatments of surfaces. Their scientific output regarding publications, conference contributions and project proposals is summed up in the annexes.

Work package 6 Innovation - Enhance and secure innovation potential, Installation of IP management procedures and policies, Training of scientists

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One motivation, amongst several others, for applying for this project was a missing IP management at INP. During the first 3 months of the project it was foreseen to employ an IP manager. The search for suitable candidates started immediately after the projects start in June 2013 and a candidate was employed (August 2013). Taking into account, that IP specialists normally work in patent law offices with a much more attractive salary, we have been quite satisfied to have the candidate convinced to work at INP. However, after a few months working at INP he and the INP decided commonly to quit the position as an IP manager at INP by the end of December 2013. Reasons for this were mainly in a different working style of him and the INP.

We started immediately with another search for a candidate as IP manager. After another month we identified another candidate as a suitable. She began her work at INP in February 2014 and continued with building up a professional IP management. In the beginning of her work at INP she set-up a professional database and IP software (see respective deliverable). Unfortunately, it turned out, that also the work style and her personal behaviour did not fit to the INP. She decided to cancel her contract and to leave the INP by the end of April 2015.

Again, we started immediately with another search for a candidate and get in touch with suitable IP professional. She started her work beginning of June 2015 at INP. Finally, we found a candidate whose work style fits to the INP. She was able to continue with the work of her two predecessors and finalise the work package tasks successful.

To secure the innovation potential at the INP, the work package was originally headed by Prof. T. Schoenemann, who was experienced in the development of IP strategies due to his successful career in industry. Unfortunately, he stopped working for INP due to other reasons in April 2014. Since then the work package was headed by the project manager Dr. H. Sawade.

The work package leader was supported by an IP manager whose main focus is on the daily work on IP issues as described below:

- technology watch,
- patent research,
- analysis and assessment of patent ideas,
- grouping of patents into patent families,
- installation of internal IP and innovation policies,
- training of project managers and program managers in terms of potential benefit of IP knowledge,
- economic valorisation of research results,
- installation of decision workflows for the institutes management,
- initiation and support of the development of technical standards in close cooperation with public standardisation bodies,
- creation of an internal reward system for inventors,
- handling legal aspects of e.g. research contracts, non-disclosure agreements, and cooperation contracts,
- co-exploitation of results connected to partnering activities.

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Additionally, we assigned a partner (Schulz-Junghans, patent attorneys, selected after evaluation of bids resulting from a tender) to perform a strategic consultation process for each of the Research Programmes at the INP.

Description of IP Management at INP

1.) Structure, process and responsibilities relevant to IP

To implement the IP strategy, the INP required a structure to arrange processes and responsibilities.

Patent Board: The Patent Board comprises the head of the board of directors, the chief financial officer and the head of the management support. The head of the board of directors judges from the scientific point of view, the chief financial officer judges from the financial point of view, and the head of the management support judges from a strategical point of view. In case of non-uniform judgement, the head of the board of directors decides finally. The Patent Board decides also on the general development of the IP portfolio based on decision papers. These decision papers will be prepared by the IP Manager on the basis of a "INP Patent Portfolio-Booklet" (see below). During each Patent Board meeting it is to be decided if, e.g. patents will be dropped, if patents will be continued, in which countries IP protection will be announced, which conditions for licenses will be offered to interested partners, etc. These case-to-case decisions will be prepared by the IP Manager. The Patent Board meeting takes place every 4-6 weeks, depending on availability of the members and number of decisions needed. In urgent cases the IP Manager asks for the opinion/decision of the Patent Board members by telephone or via email to secure a fast decision process.

IP Manager: collects information about the IP portfolio and proposes decisions to the Patent Board. The IP manager handles patent administration and patent filing, corresponds with patent offices and external patent law firms, takes care of contractual handling in regard with IP in cooperation, research and licensing contracts. As a rule, the board of directors signs license contracts or similar important document just in case the IP Manager (or her deputy) confirmed her agreement via initialling (the same rule applies at INP for all legal documents like cooperation contracts, NDA, etc.). The IP Manager organizes also patent meetings of the Research Programmes. The IP manager searches for suitable patent law firms providing a qualified service with adapted costs that could handle all the different technologies relevant at the INP dealing with plasma as a comprehensive technology in research fields of medicine, medicine technology, mechanical engineering, chemical fields, physical sciences, pharmaceutical, biological, enzymatic technologies etc.

Research Programme Patent Meetings: Information and workshop meetings are organized by the IP manager. The head of a Research Programme (six Research Programmes at INP) and his relevant staff are informed about the status of their relevant patents by the IP manager. They discuss IP aspects about present and future research projects and the status of classified patents. Strategic decisions for future patents are discussed and established. All information from the Research Programme Patent Meetings will be collected by the IP manager and are forwarded to the Patent Board for decision.

To reduce costs a patent portfolio software for handling patent administration, employee's invention matters and contract files have been installed at INP.

2.) Classification of patents

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The patent portfolio of INP has been classified into 4 groups:

class A: core patents including INP know-how important for technology transfer that should lead to exploitation of IP to industry,

class B: basic patents, which will secure future developments and research projects of INP and which are accepted having good chances for exploitation,

class C: strategic patents that are important for negotiations with cooperation partners especially industrial partners but are not of high technological importance for INP,

class D: archived patents, with low chances of exploitation and could be abandoned.

The grouping of patents into classes gives the Patent Board/board of directors/head of Research Programmes a very quick and easy overview about the status of the IP portfolio. Statistics of the development of the number of different classes of patents will allow a future evaluation of the IP development at INP. For instance, in a few years we could ask ourselves: has the number of core patents enhanced during the last 5 years, and if so, with which result in terms of income?

3.) Assignments of patents

The IP manager and the heads of the Research Programmes performed an assignment of all patents by their thematic priority. The patents and the costs thereof are linked to the respective Research Programme for better control and information. Now the administration and the heads of the Research Programmes are able to identify their costs for IP very quickly. The IP costs are covered by internal resources of the basic funding. The assignment to the Research Programmes is for informational purposes only. In case a Research Programme is somehow raising costs for IP protection exhaustively, the Patent Board will discuss about the necessity together with the head of the Research Programme and will later on decide on the future development of this single Research Programme portfolio.

4.) Research Programme IP analysis

The institute is organised in two Research Divisions, each with three Research Programmes. The status of research (application oriented research or basic research, national or international oriented, etc.) in each Research Programme is non-uniform as well as the research topics themselves are heterogeneous. To secure the innovation potential, i.e. to develop strategically the institute's patent portfolio required an IP analysis for each Research Programme. This strategic patent analysis was performed by a specialised patent law office (Schulz-Junghans, Berlin) between March and June 2015.

The patent law office analysed the patents of all Research Programmes. In several personal meetings with the heads of the Research Programmes the specialists gave advise how to proceed with every single patent of the Research Programmes portfolio. This consultation was highly appreciated by the heads of the Research Programmes. They have received a deeper insight into the “world of patents” and are now well prepared for future patent applications and further procedures. The result of consultation was summarised in a “INP Patent Portfolio-Booklet” (IP-booklet). In this document all necessary information about each patent is collected and up-dated regularly, at least once per week.

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The information contained are, e.g. history of application, summary of the invention, co-holder of the patent, classification of the patent, list of countries in which protection is claimed/planned, etc. This document serves as a basis for all decisions of the Patent Board meeting and gives a very precise and quick overview about the status of IP at the INP. Currently the “INP Patent Portfolio-Booklet” comprises of more than 100 pages including a list of the patents assignment to the research programmes and the internal file number.

5.) Framework conditions

The exploitability of generated IP at INP will be improved by measures listed above, but should be also backed up by a consequent IP contracting with cooperation, research and development partners, licensing of know-how, patents and strategic joint inventions with industry. For that reason, the IP manager established a “forms cabinet for contracts”. The process of employee’s invention handling, the general administration, the information of employees about their rights and obligations according to German employer invention law, the correct use of documents and a workflow for this procedure was established by the IP manager. The “cabinet of forms” includes therefore also documents for the scientists to inform themselves about the process of IP protection in general, about the process of announcing an invention, about the inventor’s bonus procedure, etc.

Regarding training of scientists in terms of IP in general, the IP Manager conducts information meetings whenever needed. These information meetings are based on an information meeting of a professional patent law office held at the INP before having the strategic consultation of each research programme. The high benefit of this meeting to the scientists leaded us to the decision to offer general information meetings for all interested scientists.

For a professional management we hired IP expert(s) whose tasks was to define a patent strategy, to set-up a decision structure and a respective workflow (IP management). The installation of a sophisticated patent and contract management software gives the INP the possibility to administer IP related issues in combination with any contractual issue (NDA, cooperation contract, contract research, framework contract, etc.). The process of employee’s invention handling, the general administration, the information of employees about their rights, the respective invention’s compensation and obligations according to German employer invention law have been finalised and communicated in-house. Afterwards, the focus of this work package was threefold: strategic consultation of the INP’s Research Programmes, finalisation of setting-up a professional knowledge management system, and to prepare conditions for successful technology transfer actions with regional, national and international partners from industry and commerce.

The INP decided to offer the IP manager a permanent position, which she accepted. By installing a professional IP management (strategy, processes, technical background) and having a permanent position of an IP manager, the aim of this work-package is met fully: The IP Management secures the innovation potential at INP.

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3. Potential impact of PlasmaShape, dissemination activities and exploitation results

The overall impact of the PlasmaShape project was and is tremendous. To quote the Head of the Board of Directors of the INP during his summer presentation for the INP members:" The PlasmaShape project was one of the most important projects at the INP over the last more than 10 years".

The entire institute highly appreciated the funding of the PlasmaShape project and the resulting impact. Nevertheless, as it is the nature of Coordination and Support Actions, all activities within the project are highly interactive. The most important challenge was to combine a set of measures for a maximum benefit for the scientific development of the INP, the economic development of the region, and a valuable contribution to the European Research Area. The PlasmaShape project, from our point of view, was successful in that.

Impact to scientific excellence

Doors have been opened for the development of new research areas by recruited scientists and by new cooperation with partners from all over the world. Twinning activities have supported the development of new research directions in a strong way. Examples for new research directions are:

The Research Programme Materials & Surfaces has developed a new method for the synthesis of nanomaterials in liquids by plasma. Especially graphene, which is one of the hot topics in materials science, was in the focus of research. It is now possible to synthesize graphene much more precise in terms of defined layer thickness and defined defect areas.

Copper is used for several applications where antimicrobial effects are required. The Research Program Materials & Surfaces and the Research Program Bioactive Materials have now developed a method to cover flexible materials like textiles with a copper layer. These materials could be used in medicine (antimicrobial effect) and for use in so called "intelligent textiles".

In the area of combustion engines, it is very important to know details about the chemical composition of the exhaust gases. The Research Program Decontamination is now able to analyse much better the chemical composition of the residues after treatment of exhaust gases with plasma.

The development of a new plasma source led to the possibility to treat plastics/polymers in such a way, that cell adhesion is adjustable for different regions of the same work piece. This process was known before, but because for the PlasmaShape support, the process development and the process accuracy was significantly enhanced.

Even when the PlasmaShape project was a Coordination and Support Action, several scientific results have been achieved in new research fields, but also in already existing research fields at INP. These results have been published in peer-reviewed journals, on international conferences as oral or poster contributions, and were used to prepare research project proposals. In sum 18 paper have been

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published, 20 conference contribution have been presented and more than 8 project proposals have been submitted.

The new research topics, which have been developed during and by the support of the PlasmaShape project are paving the way of the INP to become the hub for plasma technology in Europe, which was one of the goals of the PlasmaShape project.

Impact to the economic development of the region

During the course of the project INP enhanced also its activities regarding contacts to regional SME and so to initiate cooperation with regional industry, especially SMEs. During intensive discussion with the representative from the Chamber for Industry and Commerce of the region, it turned out that the most effective way to initiate contacts to regional SMEs is the invitation of regional SME networks to the INP for their network meetings. During these events we had the chance to demonstrate abilities of plasma technology to cooperate with companies for the development of new technological solutions for the benefit of the respective companies and the economic development of the region. Most of the company representatives have been impressed by the broad variety and availability of scientific instruments for improvement of production processes or design of new products. Especially companies from automotive and aerospace are now in touch with the respective heads of Research Programmes to negotiate future development projects. First projects have started already.

One of the most important activities of the project was the installation of a professional IP Management. This is now a strong basis also for future cooperation with industry since from now on we act on the same level as companies regarding IP and related issues, e.g. license contracts. This is again attracting (regional, national, and international) companies to cooperate with the INP more closely because processes and procedures are transparent and enhance confidence between the companies and the INP. And in particular confidence is the key for a successful cooperation with companies.

Also important for the cooperation with industry is the existence of a very clear catalogue of patents the INP owns. It is now possible to present to interested companies or other stakeholders very quickly the IP the INP holds. This accelerates negotiations for future cooperation. This is valid not only for externals, but also for our in-house scientists – every head of the Research Programmes is aware of the IP of his area and receives immediate support from the IP manager in case of possible exploitation. IP management turns to a strength of the INP.

The professional IP management supported activities of the INP in the area of creating of spin-offs. During the project duration the company *coldplasmatech GmbH* was founded (technological development was funded by other sources). The support of the IP manager was especially in terms of preparing and filing of needed patents and for setting up license contracts. *coldplasmatech GmbH* was one of the most successful spin-offs in Germany in 2015, in sum they received more than 10 prices during nationwide business plan competitions. The company developed a so called plasma patch on silicone basis for the treatment of large area chronic wounds.

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Impact to the European Research Area

The activities of the project helped the INP to be placed visible in the European landscape of plasma technology. Especially the organisation of the conference HAKONE 2014 and the events “Future in Plasma Science I and II” raised the international visibility of the INP enormously. This is proved by the raising number of contact requests by international scientists for cooperation and the already established cooperation mentioned above and in the periodic reports. Scientists from all over the world, who mainly did not visit the INP before, have been impressed by the excellent equipment and the challenging thematic areas the INP is working on. This strengthened network is now a solid basis for future joint projects, which will have strong impact to future scientific and technological developments.

As one highlight of European cooperation and better integration of the INP into the European Research Area is the signing of a cooperation agreement between the University Bari, Prof. Favia, and the INP on the field of biomedical research based on plasma technologies. This result is clearly related to the nomination of Prof Favia to the Advisory Board of the PlasmaShape board. Especially the extension of the board meetings with a distinct scientific part led to a high number of participants during the board meetings. There was a clear benefit participating to these board meetings to the board members. A future result of these board meetings is a cooperation agreement with Masaryk University in Brno, Czech Republic, which is in preparation and will be signed this year. In sum, project cooperation with the groups of the board members are now much more easy to build up than before due to a more personal level of scientific cooperation.

The better integration of the INP into the European Research Area is proved by the raised number of cooperation contracts, significantly increased from 2014 to 2015:

- from seven to 21 with universities,
- from four to eight with non-university research organisations, and
- from six to twelve with companies.

As another remarkable result, the INP is now involved in an international research project in the area of Plasma Medicine together with a partner from Korea, who has applied with the INP as the only international partner, for a so called GDRC project. These projects are funded by the Korean government to support scientific and technological development on an international basis on the highest possible level. Usually, partner on a level of University of Berkely, University of Oxford, etc. are nominated for such kind of proposals. With the support of the PlasmaShape project we have achieved to be nominated and finally, as from a recent government decision, funded.

Another remarkable result of the activities of the PlasmaShape project is the cooperation with Masaryk University Brno, Czech Republic. A special call for proposals was released from the German Federal Ministry for Science and Education. ERA Fellowships. The goal was to identify German research institutions to host research managers from EU13 countries to introduce them to modern research management structures and procedures. We applied for such a project and will get funded beginning of September 2016. This is remarkable because obviously the INP structure and

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procedures also in the area of research management have improved a lot so that we convinced the evaluators to get funded.

Impact to society

The research areas of the INP have direct impact to the society since they target to the societal challenges of the Europe 2020 strategy:

The Research Programme Plasma Medicine and Bioactive Surfaces address research topics such as new designed surfaces for implants, treatment of chronic wounds and, in foresight, the treatment of cancer. The societal challenge “SC1 - Health, demographic change and wellbeing” is clearly addressed.

The Research Programme Switching & Welding and Materials & Surfaces deal with projects in the area of energy transmission and materials for fuel cell development, here the societal challenges “SC3 - Secure, clean and efficient energy” and “SC4 - Smart, green and integrated transport” are addressed.

Scientists of the Research Programme address with their work the societal challenges “SC2 - Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy” and “SC5 - Climate action, environment, resource efficiency and raw materials”. Topics in these Research Programmes are e.g. the decontamination of food, the treatment of exhaust gases by plasma, and the removing of pharmaceutical residues from water.

The Research Programmes of the INP have been strengthened due to the activities of the project, and so the addressing of the societal challenges was significantly facilitated.

Promotional activities led also to a raised awareness of the INP for stakeholder from politics. Members of the federal parliament and the Bundestag visited the INP to get informed in more detail about the scientific work at INP (e.g. Mr Eckhardt Rehberg, MDB, and Mr Egbert Liskow, MDL M-V), others visited INP booths at national fairs (e.g. Prime Minister of Mecklenburg-Vorpommern Erwin Sellering, MDL M-V). One highlight was also the visit of the President of the Leibniz-Association, Prof. Matthias Kleiner, who was impressed by the collection of topics to demonstrate the institutes motto “From Idea to Prototype” which is fully in line with the motto of the Leibniz-Association “Theoria cum Praxi”.

But not just “VIPs” have been informed about the INP and its topics, during the different events for the wider public we recognized an enhanced interest for the work of the INP. For instance, events like open day, girls-day or the regional exhibition, revealed a raising number of visitors from the wider public. On the long term, this would lead to the wider public awareness that the INP is a recognized employer in the region offering a high number of different job categories.

Summary: The PlasmaShape project build up successfully the innovation capacity at INP and contributed to the further integration of the INP to the European Research Area for the benefit of the European Research Area!

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