NMP2-CT2006-033205

**IPMMAN**

**Improvement of Industrial Production Integrating Macro-, Micro- and Nanotechnologies**

Instrument Coordination Action

# IPMMAN Publishable final activity report 1st - 3rd Year

Period covered: from 01.02. 2006 to 31.01.2009 Date of preparation: 25.08.2009

Start date of project: 01/02/2006 Duration: 36 months

Project coordinator name: Dipl. Ing. Christian Wögerer, MSc
Project coordinator organisation name: **PROFACTOR Research and Solutions GmbH**

Revision: Draft 1

# Publishable executive summary

IPMMAN is a Coordinated Action project supported by the European Commission, having as ultimate goal to support, with the collaboration of other projects, the establishment of a European Technology Platform on Micro- and Nanomanufacturing and a Strategic Research Agenda. This goal will be pursued through.

- Establishment of Expert Groups and involvement of key stakeholders, including industrialists, technology providers, decision making entities, platforms and funding bodies, etc., to support the establishment of a ETP on Micro- and Nanomanufacturing.
- Technology assessment, best practices and benchmarking, with a key contribution to the definition of topics for the FP7 NMP and, in a longer term, Strategic Research Agenda for Micro- and Nanomanufacturing.
- Dissemination in close coordination with the organizers of the most relevant European events in Micro- and Nanotechnologies
- Exploitation of technologies and industrial potential through improved production methods, micro- and nanotechnologies for enhanced product properties and technological basis for the introduction of novel products and processes.
- Communication and advisory role to technology policy making bodies, funding organisations and related platforms (EC, national ministries, Eureka, ETPs, etc.)

In the second and the third year the focuses of IPMMAN was to support and establish the European Technology platform (ETP) MINAM (www.micronanomanufacturing.eu). This goal will be pursued through.

- Coordination of the expert group Nanomaterials and Integration
- Writing the SRA for Nanomaterials and Integration together with the other supporting project partners of MINAM (4M, microsapient and independent)
- Roadmapping activities and preparation of the questionnaire
- Preparing Input for the 2nd questionaire
- Attending the Roadmapping and OSG group Meetings
- Dissemination and conferences
- Preparing the MINAM ETP, writing the SRA and the Vison Paper
- Preparing the Implementation plan of the ETP
- Preparing sectorial Roadmaps for different sectors

IPMMAN's is positionied as an active communication node connecting for Manufacturing Industry, Research Institutions and Governmental and EC-Institutions and Authorities making information available for all parties. There for it is necessary to include all relevant players from Government, Industry and Research to the Platform

## Micro- and Nanomanufacturing

The MINAM Platform acts as an exchange forum for the topics of industrial manufacturing: materials, equipment, components. It aims to support industry growth in this new field by the development of a common R&D and education strategy and by enabling close cooperation of SME, Industry and Research Institutions.

Micro- and nano-manufacturing is getting more and more important for innovative applications and has a strategic importance for Europe. A new MIcro- and NAno-Manufacturing community is emerging at European level involving collaboration of

manufacturers, equipment suppliers, research organizations and networks and a technology platform is the most appropriate approach to achieve the desired outcome. They all gather in the new rising platform MINAM.

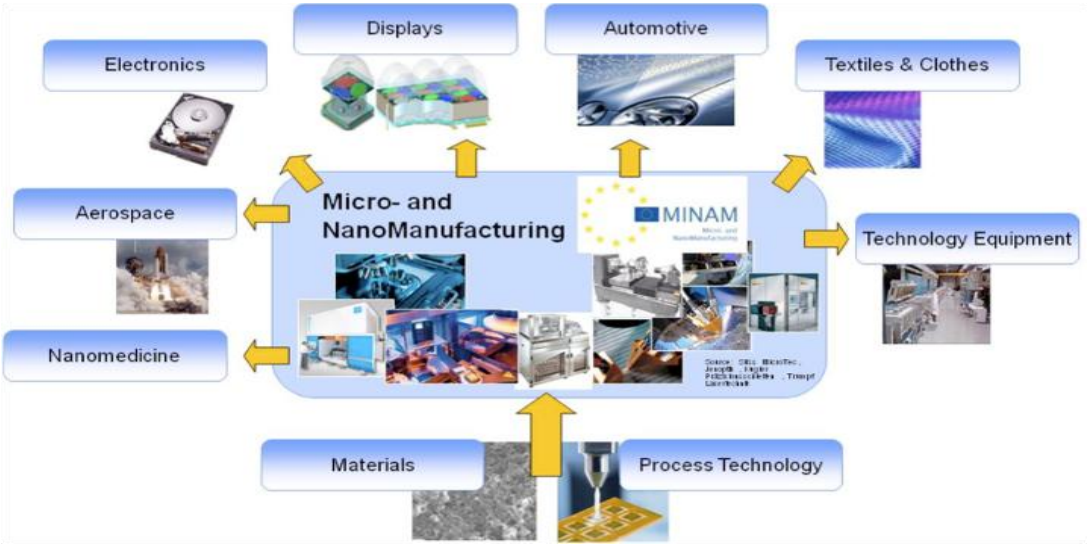


Fig: What is Micro- and Nanomanufacturing – The way from Materials and Process Technology to Applcations

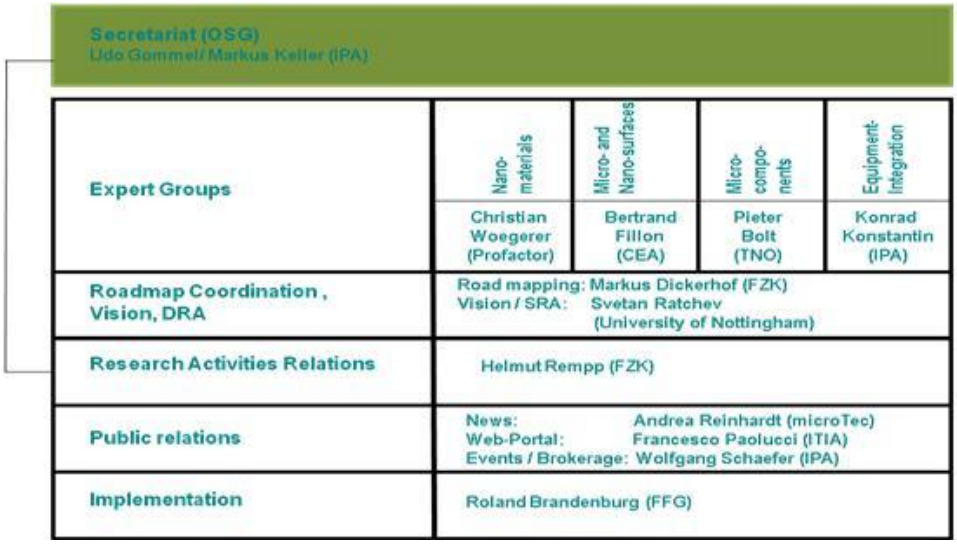


Fig: Integration of IPMMAN in the activities of MINAM ànd the OSG group.

Experts from IPMMAN are involved in each task of the MINAM Platform. The Focus of IPMMAN turned to the Vision of MINAM as described in the VISION FOR MICRO- AND NANOMANUFACTURING

## MINAM goes ETP

Therefore an application to be an cross sectorial platform was submitted in March 2009 to the EU Commission.

## Project Data

Programme: FP6- NMP
Activity Code: Coordination of European Manufacturing Research
Type of Project: Coordination Action
Start Date: February 1st 2006
Duration: 3 Years

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# INDEX

# Project execution

IPMMAN is a Coordinated Action project supported by the European Commission, having as ultimate goal to support, with the collaboration of other projects, the establishment of a European Technology Platform on Micro- and Nanomanufacturing and a Strategic Research Agenda.
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## MINAM goes ETP

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**1.) General situation:**

**SRA, Vision Paper available**: Legwork of different partners to the Vision Paper and the Strategic Research Agenda for Micro- and Nano Manufacturing of the MINAM Community based on the developed documents of the years 2006 and 2007, Updated SRA and Vison available at the beginning of Mai 2009

All Partners will continue to provide content for all work packages in which they contribute. For each involved partner a short periodic management report of 2008 was worked out. Overall aim is to promote the **MINAM- Community** by the use of the developed functionality of the MINAM web- platform.

**2.) WP 1:**
In order to produce the integrated MINAM roadmap 2.0 a strong contribution to the second questionnaire was elaborated by IPMMAN. The structure of the questionnaire exists already. Final improvement is still in progress. An expert group of IPMMAN, µSAPIENT, 4M corporately prepared this questionnaire. Pre-tests by experts from IPMMAN; µSAPIENT; 4M

and independent experts will be done in April and May. The launch of the questionnaire was in Autumn 2008 and te results are available and sectorial roadmaps for different sectors were made.
Classification-Schema of Micro- and Nano-Technologies were made. Updated classification schema was discussed by the partners. Reducing the Complexity was necessary.
SRA, Vision Paper available: Legwork of different partners to the Vision Paper and the Strategic Research Agenda for Micro- and Nano Manufacturing of the MINAM Community based on the developed documents of the years 2006 and 2007, an updatet SRA and Vision paper with the results of questionnaires are available at the end of Mai 2009

**3.) WP 2:**
In order to achieve the WP2 objectives in the first year of the project, a **Public IPMMAN Web Portal** has been developed (http://www.ipmman.eu) and a **Restricted Area** for the IPMMAN partners (http://www.ipmman.eu/intranet_ipmman/) to share documents and files has been implemented. These tasks, "*Task 2.1. Defining the structure of the two websites*" and "*Task 2.2. Set-up of the two IPMMAN Web sites*", have been conducted and concluded within the first year of the project.
Within the second year of the project, an Internet **Open Forum Area** was defined, validated and implemented.. Besides, the **MINAM Web portal** with all the different areas (Public, Download, Brokerage and Member) was defined and set-up. The *MINAM/IPMMAN Forum* and the *MINAM Web Portal* are active from the second year of the project and it will last for the entire project duration

During the third year the management, the administration and the maintenance of the web-based platforms developed in the previous years have been conduced. This tasks, "*2.4. Regular updating and maintenance of the IPMMAN main Web Portal*" and *"Task 2.6: Regular updating and maintenance of the MINAM Web Portal"* have been performed for all the project duration. Besides, in the third year, the use and the management of the MINAM/IPMMAN Forum planned in the "*Task 2.3. Internet open forum on selected thematic areas"* was performed.

**4.) WP 3:**

*During the 3rd year of activity IPMMAN partners participated at an important number of events, organized special sections, different conferences and presented scientific, review and advertising papers.*

*FZK, IPA, Profactor IPMMAN partners had an active role at the launch of MINAM Platform and Brokerage Event, which took place on January 23-24, 2008 in Brussels.*
*Christian Wogerer presented a talk (common contribution with FZK).*
*MTA-STAKI and IMT presented posters regarding their interest in micro-nanotechnologies at the Brokerage Event.*
*Other participants: MTA-STAKI, IMT, IPM*
*With this occasion MINAM Newsletter, with an important contribution of IPMMAN partners was distributed to all the participants.*

**► Events organized by IPMMAN/MINAM**

- **SEMINAR on Micro- and Nanotechnologies for Industrial Applications**

**► Sections organized in the frame of different events**

• **MINAM Special Section at** The 7-th **The Coating's** and the 3-rd **ICMEN International Conference on Manufacturing Engeneering** Conferences which took place on October 1-3, 2008 in Kassandra-Chalkidiki,

• **MINAM session** during the **MiNaT HotSpots-Industry Science Dialogue**, was organized simultaneous with **MiNAT trade fare** (International trade fair for precision mechanics and ultra-precision, micro- and nanotechnologies) in Stuttgart, Germany, 7-9, October 2008. More than 80 different companies and people represented research institutes and universities were present at different sections.

- Realization of an industrial driven workshop with partners of the MINAM Community (7th October 2008) as part of the conference **MiNaT HotSpots 2008 Industry –Science Dialogue**
- Preparation of the **MINAM Proceedings** of the whole session of the MiNaT HotSpots event (print version with 122 pages)

**FZK:** *Contribution to the different issues of the **MINAM newsletter** in cooperation with CA µSapient*

- *announcing the MINAM session at the trade fair MINaT 2008,*
- *presenting the results of the MINAM session and the experiences of the involved industrial partners efm-systems, profactor and MBN at the joint booth at the trade fair MiNaT*

• **MANUFACTURING 2008 Conference at Budapest from 5-7 November 2008**
The chairperson was **Dr. Geza Haidegger (MTA-SZTAKI, Budapest)- IPMMAN partner**.
IPMMANorganizer/ participants: **MTA-SZTAKI**, Profactor, IMT.

- **MANUFUTURE 2008 conference- Dec 2008- PROFACTOR**

## 2. Dissemination activities at different national and international events

### ► Participation at different events

Preparation of the dissemination of results about the **CA- IPMMAN as well as the sub-ETP MINAM (Vision Paper and SRA)** at the stand of ***MANUFUTURE* for the *"Karlsruher Arbeitsgespräche"* in Karlsruhe (11. and 12. March 2008).**
More than 650 attendants from industry and research participate at this event- FZK

**April, 2008-The HUNN - Hungarian Excellence Centers on Nanosciences-- (an FP6-SSAproject)** organized and hosted the *1st Functional Nanocoatings international Conference * in early April, 2008. With 150+ participants and many more visitors. The IPMMAN project, together with the established MINAM Platform was highlighted via poster presentation and distribution of flyers, and Newsletters.

**May, 2008 Budapest -** The preparation and **presentations of IPMMAN and MINAM** were delivered by the local IPMMAN- Geza Haidegger- at the launch of the **Hungarian National Technology Platform on *MANUFUTURE***, in conjunction with a major INDUSTRIA Trade exhibition and an INNOVATION Workshop

**A ROUND-TABLE Forum on Nanotechnology -** organized almost monthly by the **Hungarian Academy of Sciences**, invoked experts and those, just getting interested in the diverse aspects of nanotechnology *( participation of IPMMAN staff*- Geza Haidegger).

**Dissemination of results of IPMMAN as well as the MINAM Newsletter at 3rd Workshop "Functional Nanomaterials",** organized in **Romania,** with international

**Poster** presentation regarding **IPMMAN/MINAM activities** (IMT**)** at **CAS 2008 –** International Semiconductor Conference-**IEEE event,** October 13-15, 2008, Sinaia, Romania- 150 participants

- **IPM Russia**-Participation at preparation of WS on **Microsystems, Mechatronics, modern technologies,** 4-6 November 2008, Moscow.
- **IPM Russia**-Participation at **Nanotechnology International Forum, RUSNANOTECH** 3-5 December, 2008, Moscow - Presentation of the Paper in the Session 6, Nanoelectromechanical Systems-**IPM**-Russia.
- Participation at EUREKA project "Humanoid" discussions. Participation at Exhibitions on Micro-Nano Technologies (Moscow, Brussels). Dissemination of the results of R&D at the Conferences and WS (Baden-Baden, Germany) - **IPM Russia**
- Organization the IPMMAN-MINAM WS. Organization the Exhibition and WS, RVK "Expodesign" Co, The Russian Academy of Sciences, The Institute for Problems in Mechanics RAS, WS on Mechatronics and Robotics, Proceeding preparation, pp. 133, Moscow, November 4-6, 2008.
- **Dissemination activity at Italian level of IPMMAN project** (Scopes and structure) (established contacts with Associations and Research Institutes )- **CNR-ITIA**

- **Other participation and presentation in conferences and workshops: Profactor, MAP, PROFACTOR, ISQ, U.Lativia, IPM, IPA, Robotiker, MEC**
- **Initiating IPMMAN/MINAM** participation at **NANOISRAEL 2009** - **MATIMOP**
- **Detail-work on IPMMAN/MINAM** Participation at NANOISRAEL 2009- - **MATIMOP**

**NanoIsrael 2009, March 30-31, Jerusalem** is an unique event, bringing together a diverse group of elite dynamic speakers and participants. MINAM, the European Technological Platform (ETP) for Micro- and NanoManufacturing will participate actively in this major event.

## Contribution of IPMMAN project at MNT Future Vision- MINAM Newsletter

### ► Contributions to the MINAM- MNT Future Vision Newsletter in cooperation with Micro Sapient - printed end of March

### ► Contributions to the MINAM Newsletter MNT Future Vision October - in cooperation with Micro Sapient – printed October 2008

- Calendar of events (all the partners)
- MINAM Networks in Israel – **MAT** (Udo J. Mannes)
- New on- line survey for MNT roadmapping – M.Dickerhof and C. Woegerer- **PROFACTOR**
- A strategy for Nano in educational programmes- **MTA-SZTAKI** (Dr. G. Haidegger)
- Article about (upcoming) MiNaT Hot Spots 2008 Industry- Science Dialogue- **FZK-** (Dr. Matthias Gebauer)
- Programme of MINAM Section at MiNaT Hot Spots 2008 - 7 Oct

**Contributions to the 5th MINAM Newsletter *MNT Future Vision* October - in cooperation with Micro Sapient**

**IPMMAN contributions:**

- MINAT activities in Stuttgart (Matthias Gebauer)
- Conclusions of the IPMMAN project
- Seventh Coating Conference (Raluca Muller)

- Third ICMEN Conference (Raluca Muller) 7
- MINAM in France (Christian Woegerer)
- Manufacturing 2008 Conference (Budapest, 5/7 November 2008- Geza Haidegger, R. Muller

## ► *Contribution to MNT Nano Bulletin-edited by IMT- Bucharest*

**MEC:** ***DELILA - Development of Lithography Technology for Nanoscale Structuring of Materials Using Laser Beam Interference*****- MNT Bulletin Vol.9/No.1 - 2008**

## *Conferences*

- TMS Annual Meeting (7. – 17.3.2008, New Orleans)
- Euspen, 10th anniversary int. Conference (15. – 22.05.2008)
- Conference COMS2008, Puerta Valarta, Mexico (29.08. – 07.09.2008)
- Conference RAAD 2008, Ancona (15.9.2008)
- Conference and MINAM Presentation, Budapest (06. – 07.11.2008)
- Nanocoop08 – Presentation MINAM, Leoben (25. – 26.11.2008)
- TMS2009 Conference, San Francisco (13. – 23.2.2009)
- GMM Conference, Frankfurt (13. – 23.2.2009)
- Nanoisrael Conference, TAU Presentation (27.03. – 31.03.2009)

## *Other activities*

- Organization and preparation of the annual project meeting in Lisbon (**March 2008**) - ISQ
- Organization and preparation of the ½ year project meeting in Kassandra-Chalkidiki (3rd October 2008) - EEDM
- Participation at the ½ year project meeting in Kassandra-Chalkidiki (3rd October 2008)- all partners
- Participation at EUREKA Brokerage meeting- Kassandra-Chalkidiki- all partners -
- Participation in IPPMAN project meeting in Stuttgart (9th October 2008): FZK, Profactor, IPM, IMT, UL
- Participation at the final project meeting in Vienna (29th and 30th January 2009)- all Partners-

## Conference papers and articles

**2 Newsletter articles** (joint project activities):

**Appr. 20 Technical publications:**

**5.) WP 4:**

The goal is to support the European vision of establishing a new industry for micro- and nano- manufacturing in Europe by the establishment of a European Technology Platform (ETP) for Micro- and NanoManufactruing as a *sub-ETP of Manufuture* called MINAM. Especially, the establishment of the MINAM community as an association was in the focus of all involved partners. Therefore a lot of work was done in the third period of the project in Work Package 4 in order to support the final aim to get an official launch of the ETP MINAM in Europe based on a legal fundament.

Besides a clear strategy for the new industry it is important that national and regional political authorities have the possibility to bundle their activities with the activities of the European Commission.

## Project relation to state of the art

IPMMAN is a part of MINAM, the European Technology Platform for Micro and Nanomanufacturing. Micro- and NanoManufacturing is getting more and more important for innovative applications and has a strategic importance for Europe. A new Micro- and NanoManufacturing community is emerging at European level involving collaboration of manufacturers of micro- and/or nano-inside-products, equipment suppliers, research organisations and networks.

## MINAM Organization

In the following chapter the Minam organization is briefly described, following by a detailed explanation of different activities and sections.

## Involvement of the Industry

The participation of the industry is highly recommended for its members are the moving forces within the ETP. Therefore the actual participation of 30% of industry is about to be raised up to 75% in 2010.
The organizational structure is shown in figure 8. The OSG secretariat holds members from research institutes and non-profit initiatives; the IMG secretariat gathers all the industrial members. MINAM is an industrial led ETP. The members come together in the general assembly to make decisions applying with the platform. For special areas and kind of interest there are experts coordinating the MINAM roadmap, SRA and vision information plus implementation and public relations which will be approached in chapter 6.
A central core of the structure is formed by the Expert groups. They give valuable input for the SRA for they handle the basic fields of interest that MINAM works in like nano materials or micro components. These groups have an own inner structure with group leaders and a constantly member staff. For a nearer explanation of them see chapter 3.4.
It turned out that coordination between the experts is one key of success. The motivation lies in the common interests of all the participants.
The OSG and IMG Secretariats have the role of controlling in- and output of the groups, defining their role and collaboration.

The structure of MINAM is supposed to be of a strong, close but also flat hierarchy.

**MINAM Structure**

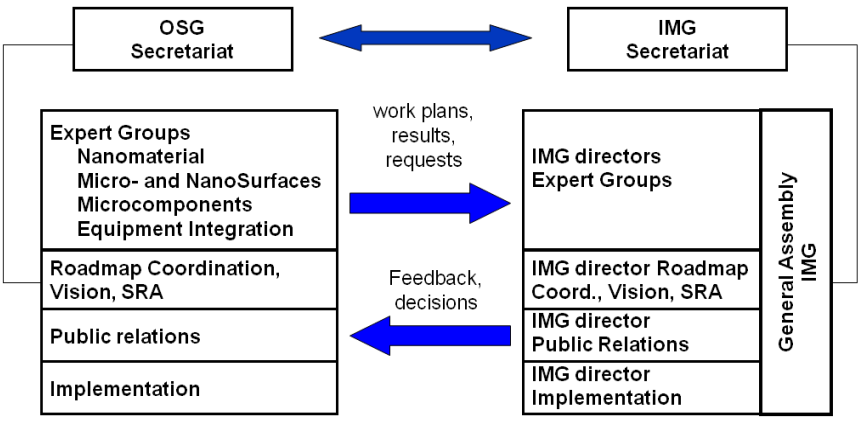


Figure : MINAM Structure

Every ETP needs to define its visions and strategic plans. Mostly this is written down in the respective documents. At MINAM there is a Strategic research agenda (SRA), a roadmap and a vision paper, which are updated periodically.

## MINAM Roadmapping

The development of the MINAM strategic research agenda has been informed by ongoing coordinated roadmapping activities. These are aimed at providing holistic overview linking together the major driving factors, such as, applications, market requirements and technological capabilities of a highly interdisciplinary field where a lot of information on segmented aspects is available

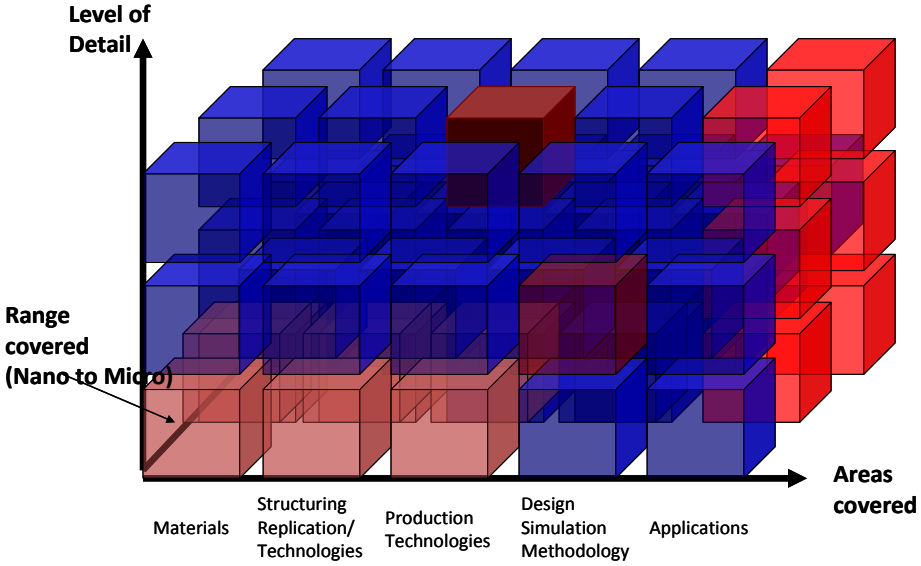



Figure: MINAM roadmapping cube

The outcome of this process leads to formulating a holistic view based on different roadmaps, Studies, expert workshops and surveys making the partial results comparable. For MINAM roadmapping a novel “meta”-methodology has been discussed and agreed upon to allow the combination of results from market and application driven information while focussing on technological aspects, addressing micro- nanomanufacturing techniques for production of parts and the assembly of Microsystems
A comparison of information available from both, technology and application perspectives during the course of MINAM roadmapping activities facilitates a more precise description of the technology-application push-pull link and facilitates the development of a common understanding of needs and barriers faced by the MINAM community. It also strengthens the integration of the different positions (end-users, technologists and equipment providers) in the MINAM process.

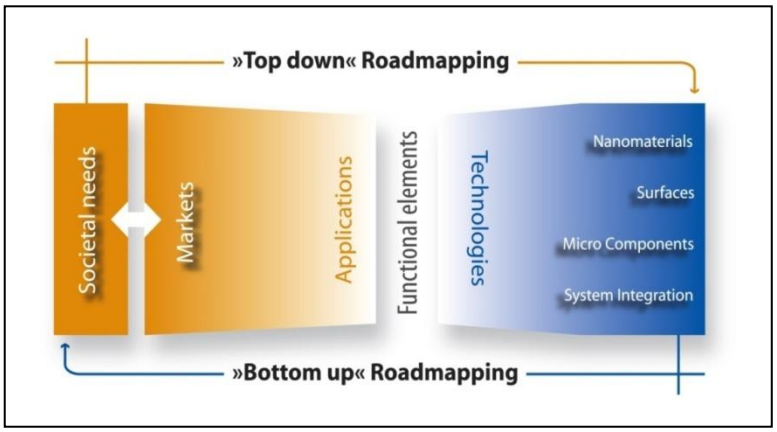



Figure 10: The MINAM roadmapping methodology

With a view to creating excellence and enhancing industrial competitiveness in all areas which are of crucial relevance for the achievement of the European micro- and nanomanufacturing vision, a number of activities have been initiated to identify key areas and topics on a detailed level.

Besides the feedback received through expert workshops the MINAM survey 2008/2009 was the most prominent activity of the last year. It underpins MINAM´s claim to provide substantial input for strategic decisions. More than 220 participants identified need and hurdles for more than 78 technologies in the field of Micro and Nano production. The results also showed the relevance of MicroNano technologies for the further development of micro nano enhanced applications. The outcome led to the identification of 11 partial roadmaps for key field of innovation in Europe.

MINAM roadmapping will continuously analyse in detail the requirements of both, customers and technology providers, and report emerging trends to the MINAM community once a year.

## SRA

The SRA outlines key challenges and research priorities with the objective of accelerating the development of new micro- and nano manufacturing technologies and their rapid transformation from laboratory based prototypes into volume manufacturing applications. Key objective is to identify emerging trends and provide strategic directions for future investments in R&D to accelerate the rapid transition of micro- and nano manufacturing technologies from laboratory based prototypes into volume manufacturing applications. Normally an ETP has to pass through three stages,

***STAGE 1: Stakeholders getting together*** *in order to establish their "vision" for the future development of the field concerned and to set up the technology platform;*
***STAGE 2: Stakeholders define a Strategic Research Agenda*** *setting out their common views on the necessary medium to long term research, development and demonstration needs for this technology;*
***STAGE 3: Implementation of the Strategic Research Agenda*** *- for which, in many instances, it is anticipated that significant public and private investments will need to be mobilized.*

The research agenda considers the social impact concerning the environment and the benefits one can gain plus the economical impact corresponding the new speeding up

markets which call for a faster life cycle in combination with individual adapted mass products – which in fact is a big challenge. Figure below shows just the segments in the micro sector, but one may get an idea of the possibility diversity of applications when dealing with micro and nano technologies.

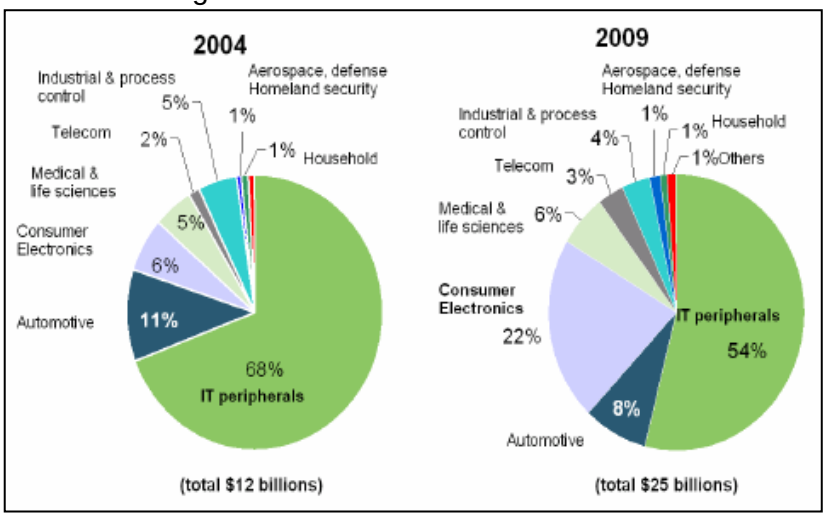



Figure: Microsystems market per segments; source: MINAM SRA

MINAM is dealing with four mayor groups of research, namely manufacturing of nano materials, manufacturing of micro and nano surfaces, manufacturing of micro components and equipment integration (Integrated micro and nano manufacturing systems and platforms). An agenda is important to have a common plan. Figure below shows the expected time span in which nanotechnology impacts on society and industry. MINAM has a liability for it is the organ of a whole technological field which in fact is still pretty new but growing sector.

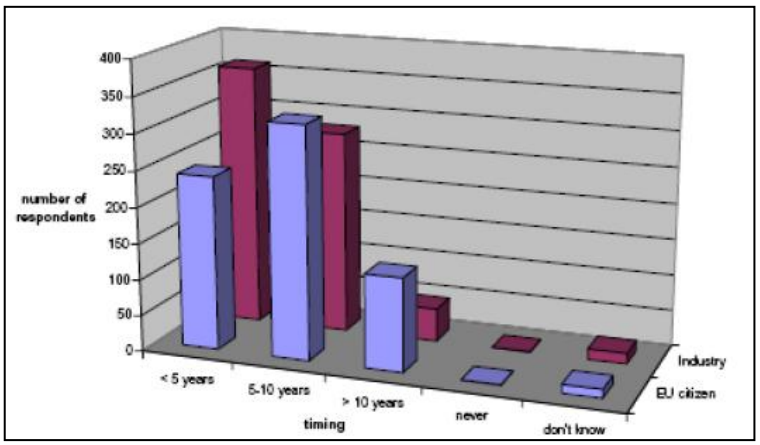



Figure : Expected time span in which nanotechnology will effect on society and industry

The task for MINAM is now to refine and actualize the SRA. The stage of implementation can be a very long term task. It is the purpose of MINAM to keep the SRA in the interest of all the participant stakeholders. The SRA is being defined within technology platforms are expected to be suitable for support through the main, existing collaborative research instruments which will be maintained under FP7.

## Vision paper

The micro- and nanomanufacturing vision summarizes key points from the strategic research agenda (SRA) of the European Micro- and Nanomanufacturing technology platform MINAM.

A key objective of the MINAM vision is to identify emerging trends and provide strategic directions for future investment in research and development aimed at sustaining and further enhancing the leading positions of the European industry in micro- and nanomanufacturing technologies. In particular the MINAM vision addresses the strategic research priorities in four key areas:manufacturing of nanomaterials, processing of nanosurfaces, micromanufacturing processes and the development of integrated systems and platforms for micro- and nanomanufacturing. In the preparation of the document, members of µ-Sapient, IPMMAN and 4M worked alongside various industrial and voluntary contributors.

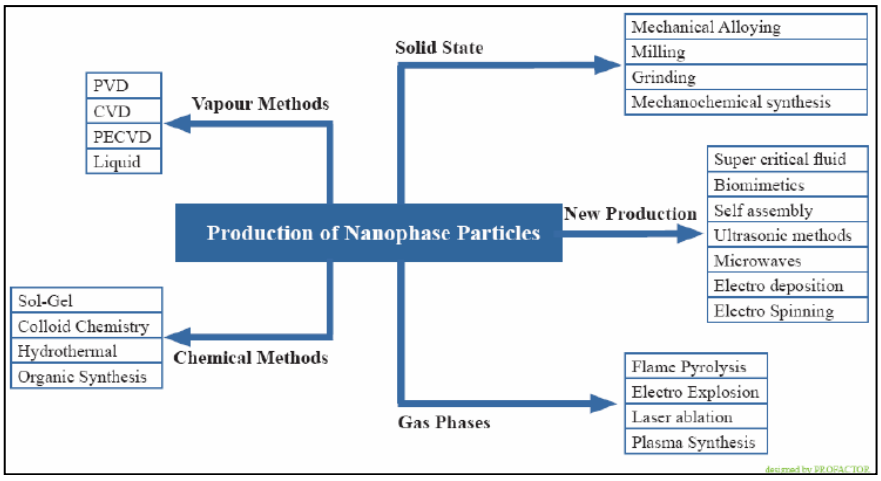
## Expert Groups

Corresponding to the four big topics of the SRA there are four Expert groups formed within the MINAM platform:

- Manufacturing of nano materials
- Manufacturing of micro and nano surfaces
- Manufacturing of micro components
- Equipment integration (Integrated micro and nano manufacturing systems and platforms)

They form the basis for future developments described in the SRA.

**"Nano materials"** mainly deals with nano-phase particles in solid and gas phase plus new production e.g. of critical fluids, vapour and chemical methods. To achieve structure sizes in the medium and also lower nanorange the top-down method is trying to enhance the methods from microtechnology. The scope of nano materials can be seen in figure below. It shows all the relevant methods and technical fields.

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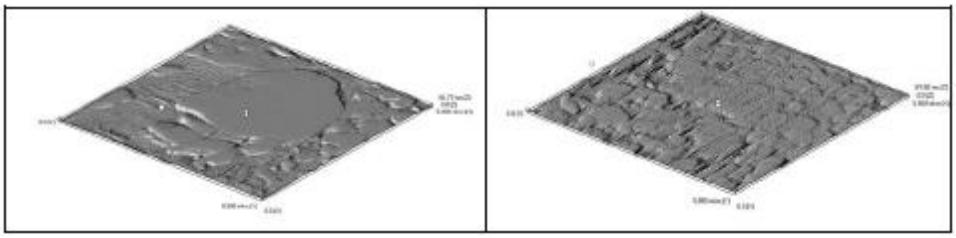

Figure: left: nanostructural coating; right: conventional coating

**"Micro components"** are manufactured by new emerging methods like rapid manufacturing and micro tooling. This is about forming, replication, injection moulding and a lot of more methods also using 3D computer programs as support. Enduring challenges are the shaping of 3D components that meet both functional and economical demands. In high-volume production, mould based replication is often most suited, while small-volume production environment is often more economical. A trend is to integrate functionalities such as interconnect and interfaces in components in order to reduce the number of parts and/or assembly costs.

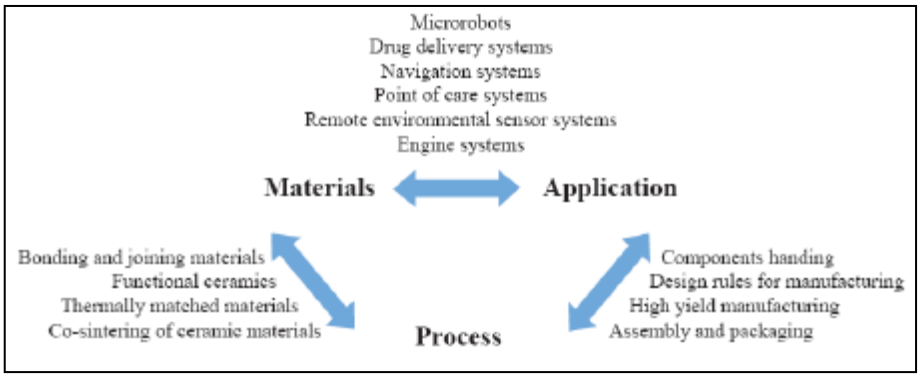


Figure : Strategic development for industrialization and function integration

Finally **"equipment integration"** shows today's possibilities and future trends of micro and nano components in daily life. The manufacturing of customised products in a cost efficient way, both for high volume and also for small and medium lot sizes, will require the development of a new generation of modular, knowledge intensive, scalable and rapidly deployable systems. They will use the emerging technologies from micro- and nanoresearch combining them with a very flexible industrial production philosophy. A common problem, for instance, is the assembly of micro- and nano components into larger systems which is a critical production step representing up to 80% of the system's cost.

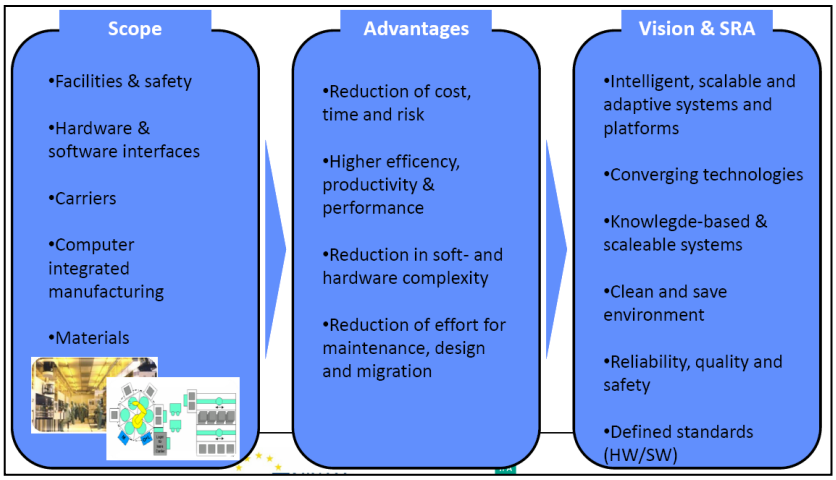

Figure: scope and vision for equipment integration

## Members Structure

To be effective, platforms should involve and reflect the needs of all stakeholders. Targeted actions may be necessary to reach specific audiences, such as small and medium-sized enterprises (SMEs), end-users and civil society. Members of MINAM mostly are part of the industrial management group or the operations support group, for they come from the industry as well as from research institutes, see Figure 17. The online count in February 2009 is about 600 members. MINAM also is in contact with Non-governmental organizations e.g. the Berufsgenossenschaft (professional association). These alliances will be strengthened as well as the one to the political parties on national and international level like the European Commission.

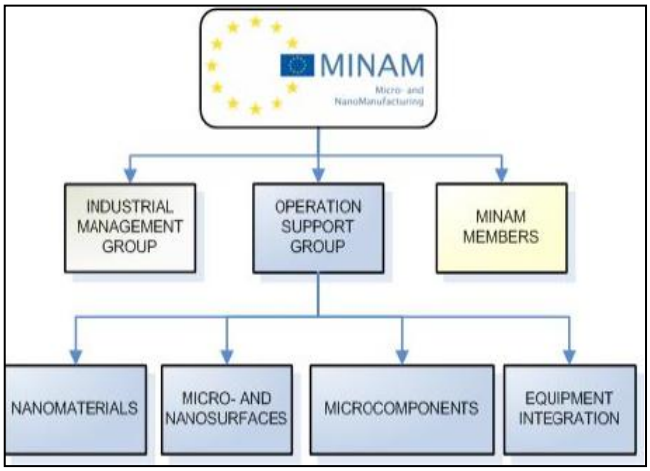


Figure: Members structure

# Conclusion of the IPMMAN Project

MNT FUTURE VISION SPECIAL New Phase in MINAM Expansion Page 5

## Conclusions of the IPMMAN project

The Final Meeting of the FP6 European Project IPMMAN – Improvement of Industrial Production Integrating Macro-, Micro- and Nanotechnologies (http://www.ipmman.eu/) took place in Vienna, Austria (28-29 January 2009).

The Project coordinator Dipl. Christian Woegerer, from PROFACTOR and the activity leaders presented the activities reports and deliverables for the last year. Also general discussions and conclusions were presented by the Project coordinator and by Project Officer, Kai Peters. All partners participated at fruitful discussions about the results of the project and future work to be done for the MINAM Platform.

IPMMAN project contributed to the strength of different links between the European Manufacturing Industry and research initiatives (regional and Commission RTD Projects, EUREKA, etc.), leading to the improvement of competitiveness and sustainability of the European manufacturing community, merging macro-, micro- and nano-tech to foster industrial innovation.

Collaborating with other projects (CA MicroSapient and NoE 4M), IPMMAN, which was a coordinated action project, played an active role and contributed to the:

- Establishment of the European Micro and Nanomanufacturing Platform- MINAM (sub-platform of MANUFUTURE);
- Vision Paper and Strategic Research Agenda for Micro- and Nanomanufacturing, contributing to the definition of topics in FP7- in a longer term, highlighting the industrial development in the next years.

The work within IPMMAN project was focussed on:

- Establishment of expert group covering specific topics: Nanoparticles, Nanosurfaces, Microproduction and Equipment integration. Key stakeholders, people from industry, technology providers, people from academia, decision entities were actively involved;
- Dissemination as special dedicated sections, organised in close cooperation with most relevant European Events in micro-nanomanufacturing, focused talks on micro and nano-manufacturing within a great number of conferences, workshops, exhibitions;
- Exploitation of technologies and industrial potential through improved production methods, micro- and nanotechnologies, novel products and processes;
- Communication and advisory role to technology policy making bodies, funding organisations and related platforms (EC, national ministries, Eureka, Manufuture).

IPMMAN project looked out to the communication strategy of for the whole community of Micro- and Nano Manufacturing (MINAM) and prepared and supported the development of the common IPMMAN web portal, as well as the web-portal of the MINAM community, by exchanging ideas about different solutions, by conceptual work. IPMMAN also contributed to the MINAM newsletter.

All the objectives of the project were successfully fulfilled and the work of the 13 partners involved contributed to the establishment and support of the MINAM Platform for Micro and Nanotechnology manufacturing.

Dr. Helmut Ramp - IPMMAN Final Meeting

Project coordinator, Dipl. Christian Woegerer from Profactor Produktionsforschungs GmbH

# Dissemination and use

## MINAM Platform

Micro- and nano-manufacturing is getting more and more important for innovative applications and has a strategic importance for Europe. A new **MI**cro- and **NA**no-**M**anufacturing community is emerging at European level involving collaboration of manufacturers, equipment suppliers, research organizations and networks and a technology platform is the most appropriate approach to achieve the desired outcome. They all gather in the new rising platform MINAM.

## European Technology Platforms (ETP)

European Technology Platforms can be understood as an industry driven framework for stakeholders, to define research and development priorities plus strategically important issues.

ETPs play a key role to allow for a focus of research funding on areas with much industrial relevance: This in fact is done by including the whole economic value chain plus mobilizing public authorities at international, national and regional levels. The conveyance of public-private partnerships is obligatory for ETPs have the potential to contribute significantly to the renewed Lisbon strategy, which provides the EU within ten years to be a dynamic competitive economical and knowledge based research area. European research policy wouldn't be the same without its platforms they contribute to the Seventh Research Framework Program (FP7) to better meet the needs of industry.
Technology platforms are the best way to achieve the desired aims, because they address technological challenges that can potentially chip in a number of key policy objectives, timely development and deployment of new technologies, technology development with a view to sustainable development, new technology-based public goods and services, technological breakthroughs and the restructuring of traditional industrial sectors.

## MINAM Organization

In the following chapter the Minam organization is briefly described, following by a detailed explanation of different activities and sections.

## Involvement of the Industry

The participation of the industry is highly recommended for its members are the moving forces within the ETP. Therefore the actual participation of 30% of industry is about to be raised up to 75% in 2010.
The organizational structure is shown in figure 8. The OSG secretariat holds members from research institutes and non-profit initiatives; the IMG secretariat gathers all the industrial members. MINAM is an industrial led ETP. The members come together in the general assembly to make decisions applying with the platform. For special areas and kind of interest there are experts coordinating the MINAM roadmap, SRA and vision information plus implementation and public relations which will be approached in chapter 6.
A central core of the structure is formed by the Expert groups. They give valuable input for the SRA for they handle the basic fields of interest that MINAM works in like nano materials or micro components. These groups have an own inner structure with group leaders and a constantly member staff. For a nearer explanation of them see chapter 3.4.
It turned out that coordination between the experts is one key of success. The motivation lies in the common interests of all the participants.
The OSG and IMG Secretariats have the role of controlling in- and output of the groups, defining their role and collaboration.

The structure of MINAM is supposed to be of a strong, close but also flat hierarchy.

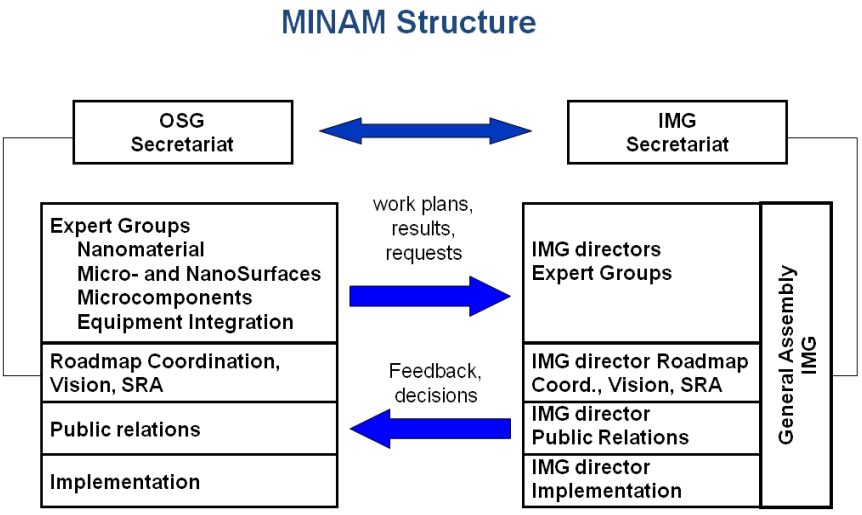


Figure : MINAM Structure

Every ETP needs to define its visions and strategic plans. Mostly this is written down in the respective documents. At MINAM there is a Strategic research agenda (SRA), a roadmap and a vision paper, which are updated periodically.

## MINAM Roadmapping

The development of the MINAM strategic research agenda has been informed by ongoing coordinated roadmapping activities. These are aimed at providing holistic overview linking together the major driving factors, such as, applications, market requirements and technological capabilities of a highly interdisciplinary field where a lot of information on segmented aspects is available

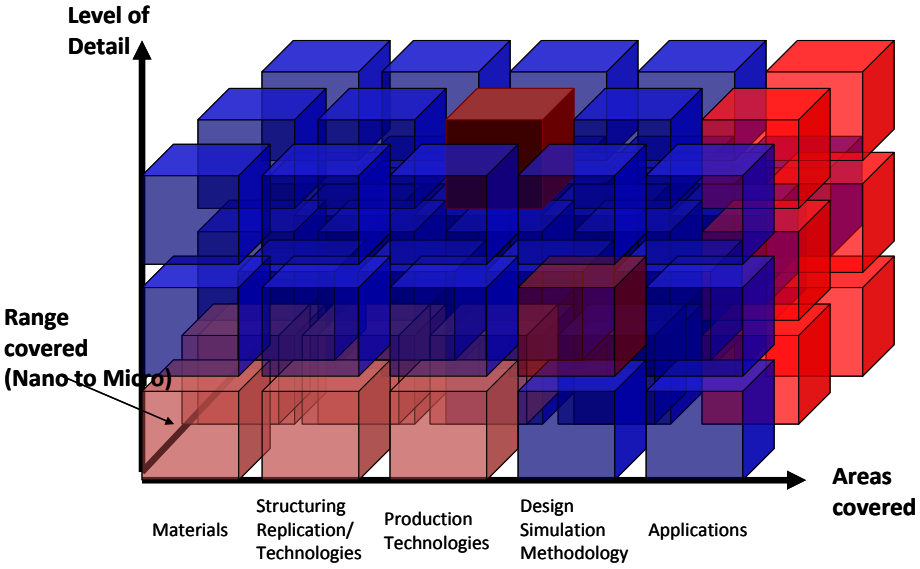


Figure: MINAM roadmapping cube

The outcome of this process leads to formulating a holistic view based on different roadmaps, Studies, expert workshops and surveys making the partial results comparable. For MINAM roadmapping a novel “meta”-methodology has been discussed and agreed upon

to allow the combination of results from market and application driven information while focussing on technological aspects, addressing micro- nanomanufacturing techniques for production of parts and the assembly of Microsystems
A comparison of information available from both, technology and application perspectives during the course of MINAM roadmapping activities facilitates a more precise description of the technology-application push-pull link and facilitates the development of a common understanding of needs and barriers faced by the MINAM community. It also strengthens the integration of the different positions (end-users, technologists and equipment providers) in the MINAM process.

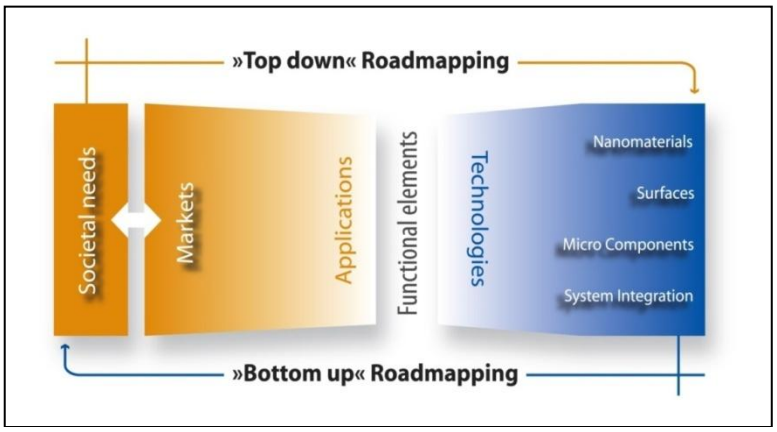


Figure 10: The MINAM roadmapping methodology

With a view to creating excellence and enhancing industrial competitiveness in all areas which are of crucial relevance for the achievement of the European micro- and nanomanufacturing vision, a number of activities have been initiated to identify key areas and topics on a detailed level.

Besides the feedback received through expert workshops the MINAM survey 2008/2009 was the most prominent activity of the last year. It underpins MINAM´s claim to provide substantial input for strategic decisions. More than 220 participants identified need and hurdles for more than 78 technologies in the field of Micro and Nano production. The results also showed the relevance of MicroNano technologies for the further development of micro nano enhanced applications. The outcome led to the identification of 11 partial roadmaps for key field of innovation in Europe.

MINAM roadmapping will continuously analyse in detail the requirements of both, customers and technology providers, and report emerging trends to the MINAM community once a year.

## SRA

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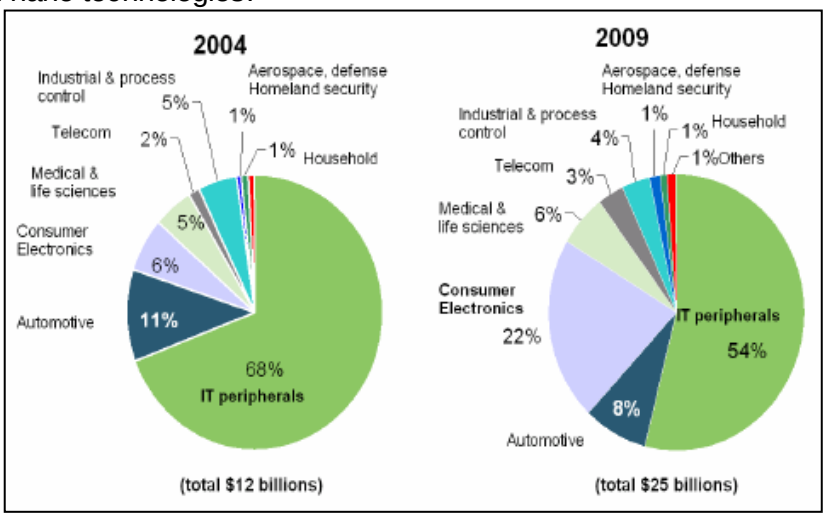


Figure: Microsystems market per segments; source: MINAM SRA

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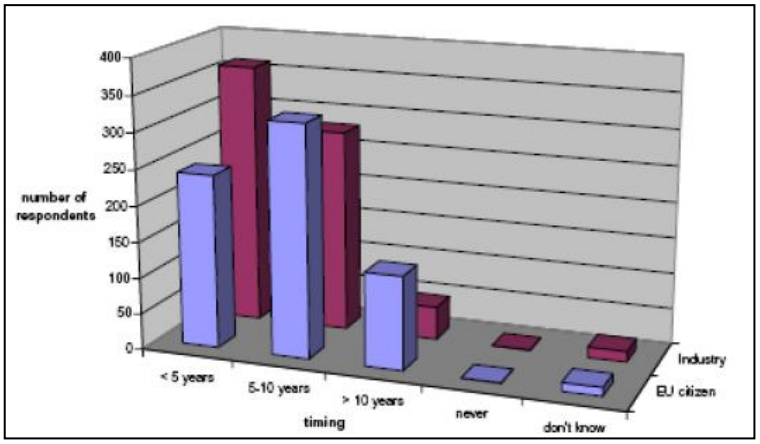


Figure : Expected time span in which nanotechnology will effect on society and industry

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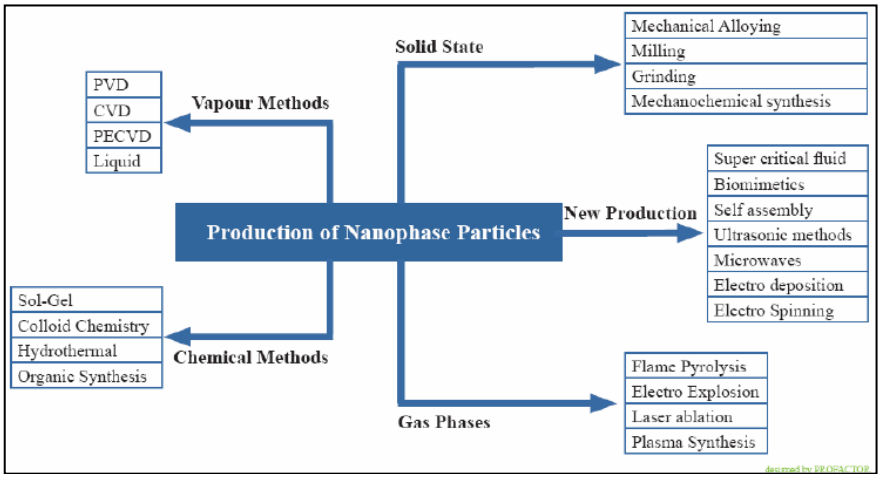


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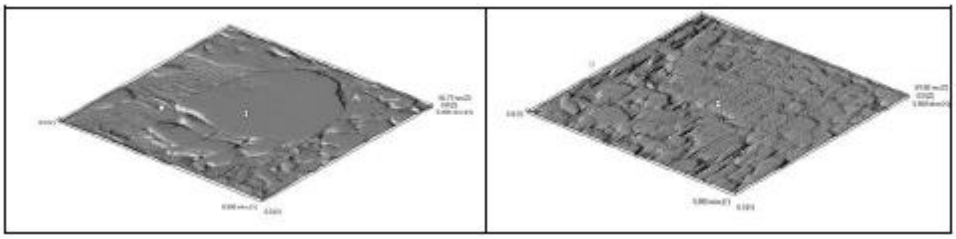

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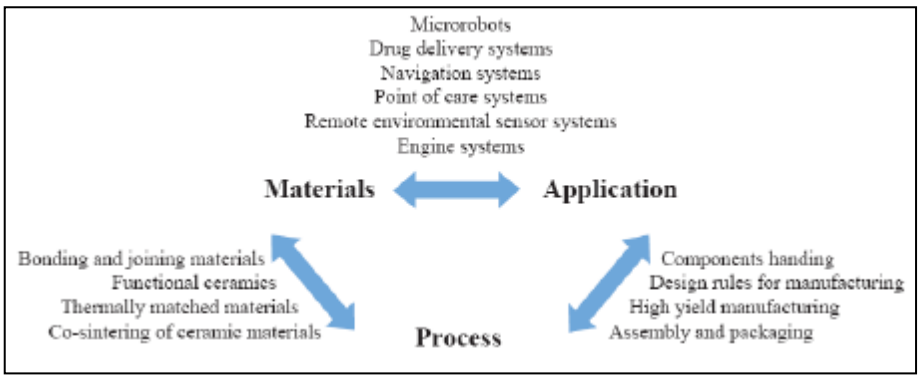


Figure : Strategic development for industrialization and function integration

Finally **"equipment integration"** shows today's possibilities and future trends of micro and nano components in daily life. The manufacturing of customised products in a cost efficient way, both for high volume and also for small and medium lot sizes, will require the development of a new generation of modular, knowledge intensive, scalable and rapidly deployable systems. They will use the emerging technologies from micro- and nanoresearch combining them with a very flexible industrial production philosophy. A common problem, for instance, is the assembly of micro- and nano components into larger systems which is a critical production step representing up to 80% of the system's cost.

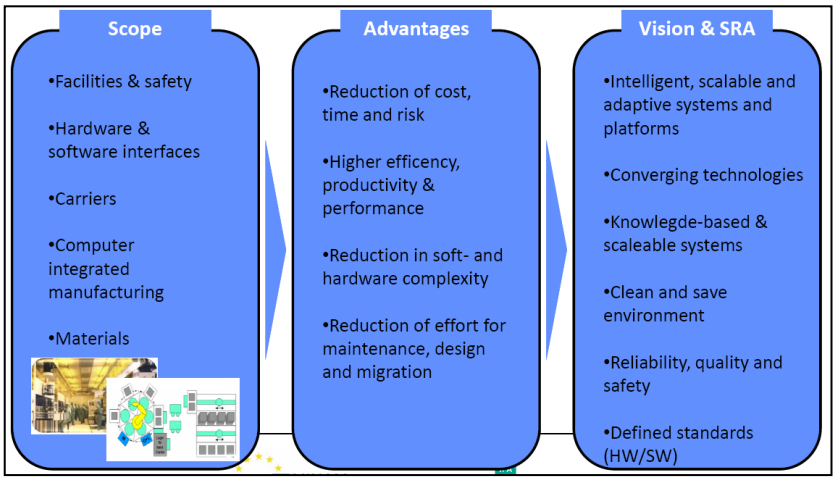


Figure: scope and vision for equipment integration

## Members Structure

To be effective, platforms should involve and reflect the needs of all stakeholders. Targeted actions may be necessary to reach specific audiences, such as small and medium-sized enterprises (SMEs), end-users and civil society. Members of MINAM mostly are part of the industrial management group or the operations support group, for they come from the industry as well as from research institutes, see Figure 17. The online count in February 2009 is about 600 members. MINAM also is in contact with Non-governmental organizations e.g. the Berufsgenossenschaft (professional association). These alliances will be strengthened as well as the one to the political parties on national and international level like the European Commission.

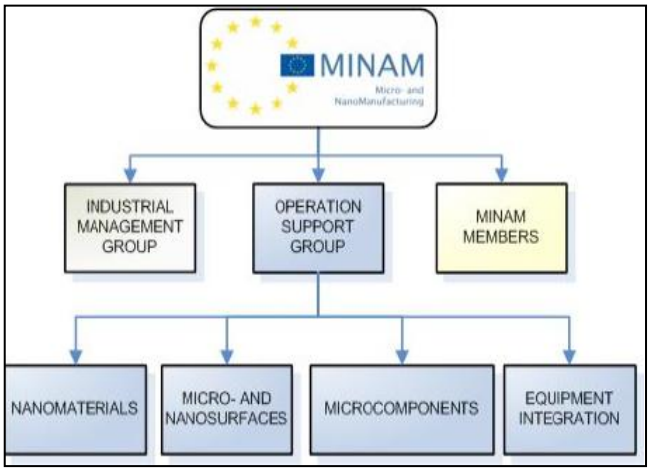


Figure: Members structure

**Its primary visions are**

- to establish a new industry for the manufacturing of products based on emerging micro- and nanotechnologies
- to develop Europe as the leading location for the production of nano-particles, micro- and nano-structures and components with “micro/nano inside
- to establish the complete value chain leading to the manufacturing of European micro- and nanotechnology products

- to ensure that the new micro- and nano-products are produced at European facilities using equipment and systems of European origin thus overcoming the current situation in which only R&D, pilot cases and first production lines are set in Europe.

MINAM ETP will have an instrumental branch in the MINAM association already founded in Bruxelles.

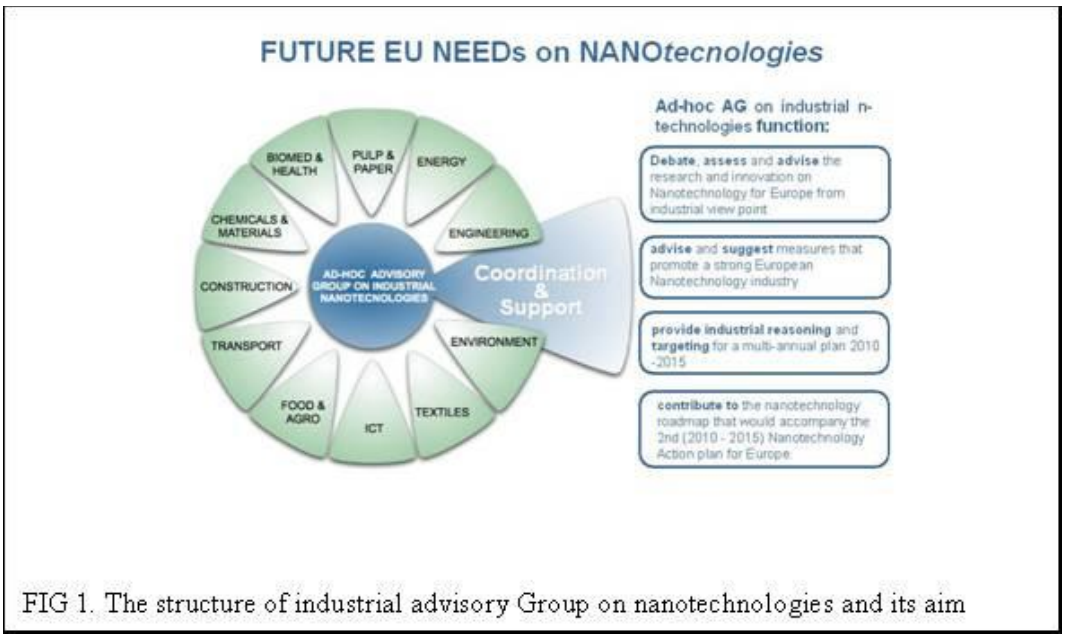


FIG 1. The structure of industrial advisory Group on nanotechnologies and its aim

A recently constituted Industrial Advisory Group within the unit Nanoscience of DG Industrial Research has been assigned the duty to draw the future EU needs on Nanotechnologies, as shown in the picture. The group consists of representatives of several ETPs having “nano-needs”. In this Group MINAM is well represented with some 40% of invited participants.
MINAM ETP and its operative branch MINAM association has the inspiration to act as a sort of “NANO-HUB” by linking external entities (others JTIs, associations, others ETPs) with its experts group under the industry driven management structure and strong operational secretariat, according to Fig. 2

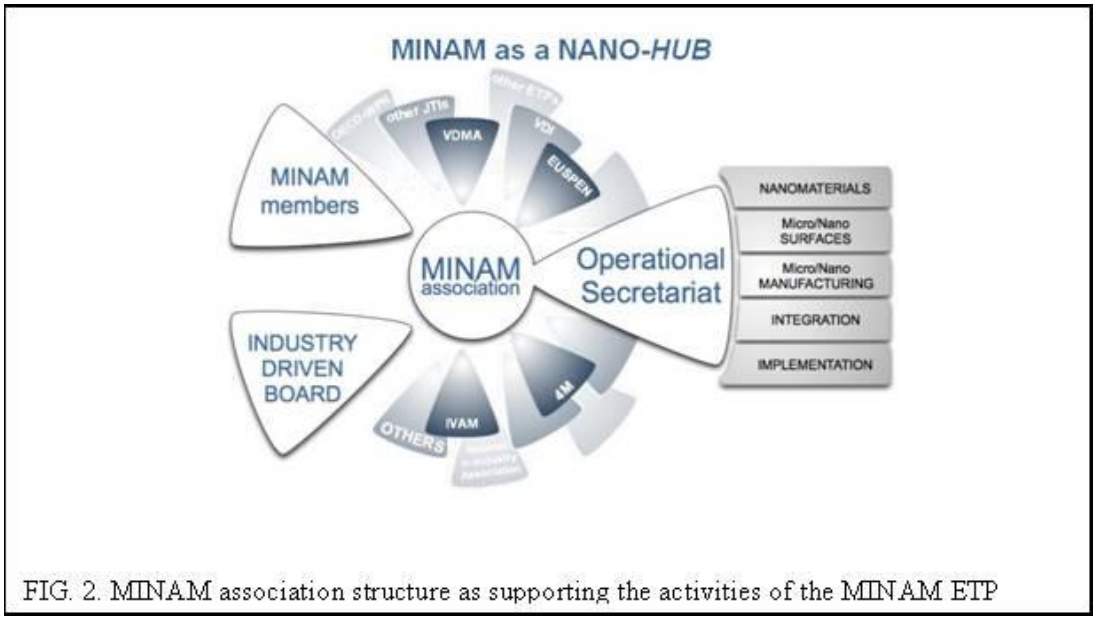


FIG. 2. MINAM association structure as supporting the activities of the MINAM ETP

This connects nicely with the role being played by MINAM within the n-Industrial Advisory Group, as shown in the following Figure 3. MINAM becomes the backbone, or central platform which collects and synthesize EU needs in nanotechnologies tracing the Europe's NANOFUTURES. **MINAM NANOFUTURES** will work in close coordination with the Commission (Unit Nanoscience) within an intense program of coordination and concerted actions activities having the goal of building a Nanotechnology Action Plan for Europe for 2010-2015.

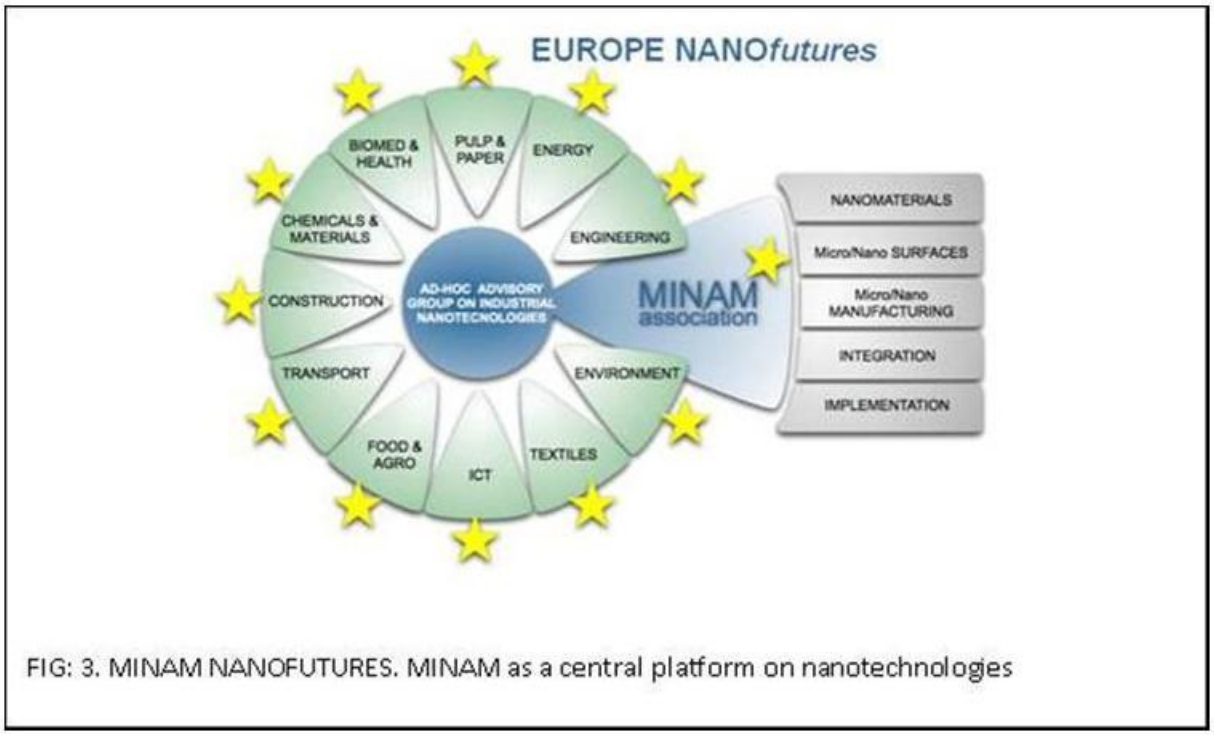


FIG: 3. MINAM NANOFUTURES. MINAM as a central platform on nanotechnologies

MINAM NANOFUTURES will be built up around EU level activities and National Mirrors, to integrate and coordinate policies on Nanotechnologies at National and Community Level. National Mirroring, involving National authorities, industries and research institutions will complement the EU level activity to delineate possibly and jointly with the Action Plan a **LARGE SCALE INITIAVE on INDUSTRIAL NANOTECHNOLOGIES** in which MINAM ETP and the Association will be the engine.

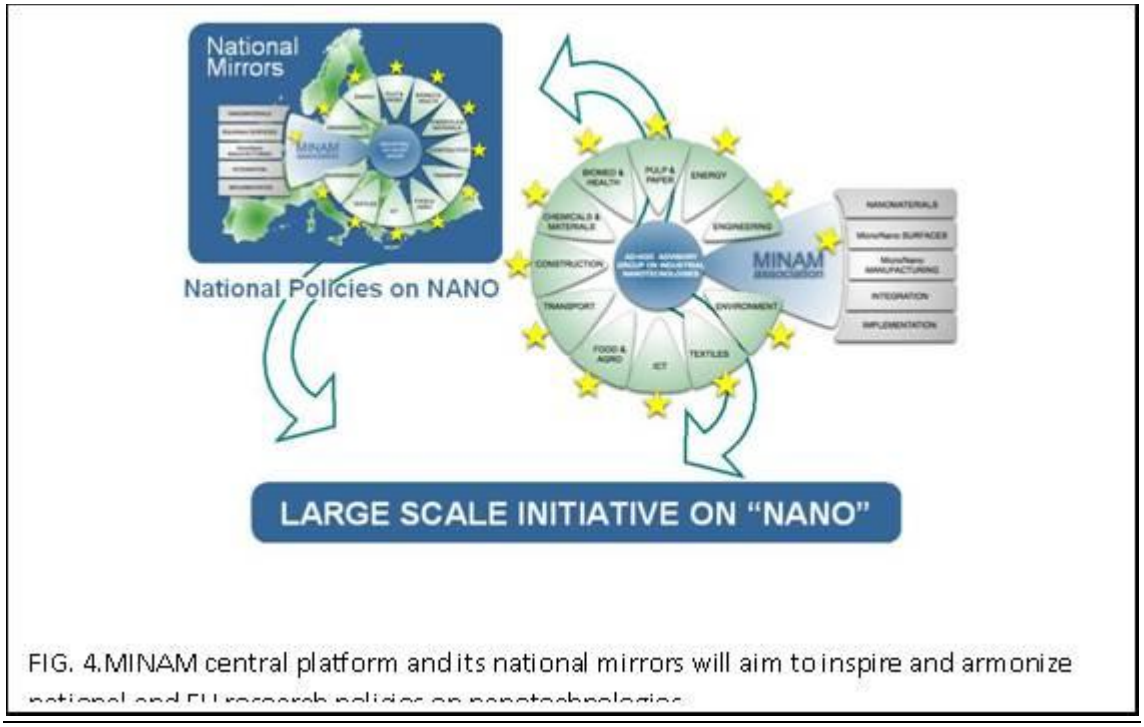


FIG. 4.MINAM central platform and its national mirrors will aim to inspire and armonize

## Publishable Results of the plan for using and disseminating Knowledge

The MINAM SRA and the Vision paper are available to the public as downloadable document both from the public from the MINAM Webpage.

http://www.minamwebportal.eu/index.php?m1=Download-Area&l1=MINAM-Documents

All relevant results are available at the MINAM and the IPMMAN Homepage

www.micronanomanufacturing.eu and www.ipmman.eu