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European Manufacturing Visions ManVis 2020

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Background

Europe has set itself the goal of becoming the most competitive economy in the world by the year 2010. Manufacturing is one of its strongest economic sectors. It provides a total of 27 million jobs and creates more than €1,300B in added value each year. In order to develop strategies for maintaining and improving the competitive strength of manufacturing industries in Europe, both industry and politics need convincing visions of the future of manufacturing in Europe. This is the background for the ManVis or 'Manufacturing Visions' project. The goal was to develop innovative and creative visions of European manufacturing for the coming decades.

Powerful Visions of the Future of Manufacturing

The ManVis project is an SSA or Specific Support Action financed by the European Commission. It was designed to accompany an ongoing process of developing policies to enhance the competitiveness of European manufacturing industries using a Foresight approach that includes the views of a wide range of European manufacturing experts. It was launched in 2003 in response to the following factors:

- Results from previous foresight activities and from empirical surveys indicated that manufacturing in Europe needed to strengthen its innovation capacity and to adopt a more proactive stance in the face of an increasing pace of product innovation.
- A trend towards and an increasing debate on the relocation of manufacturing outside Europe.
- Commission activities in support of manufacturing including MATAP – the Manufacturing Action Plan.

- The Need to define research priorities for the NMP action line of FP7 dealing with Nano-technologies, Materials and Production.

Industry, government, and other stakeholders need a strong vision on the future of the European economy based on an assessment of possible alternatives in order to develop their strategies. Such strong visions however do not appear spontaneously, nor can they be simply 'declared' by state authorities. They are not based on single perspectives or over specialised approaches. For these reasons a new knowledge community was created, concerned with the future of manufacturing, including as many actors and stakeholders as possible from Europe and all over the world.

Pan-European Delphi

As a tool to initiate future-oriented thinking and stimulate the involvement of people with diverse perspectives, the ManVis project launched a pan-European Delphi survey on manufacturing issues. The advantage of this approach is its



ability to collect a large amount of information in structured form.

Manufacturing experts from Europe and overseas contributed to the shaping of the survey through a series of workshops. In order to avoid an isolated view of European manufacturing issues, experts from outside Europe were involved in the development of the statements of the Delphi questionnaire and commented on the results of the survey. An important aim of this project was to emphasise and elaborate demand side perspectives on manufacturing. For this reason consumers and other societal groups concerned with the future of manufacturing were involved in discussions on the findings of the Delphi survey. In parallel to the Delphi activities, scenarios were elaborated on the development of the demand side of manufacturing.

The ManVis Delphi survey was launched in 22 European countries - Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Turkey and the United Kingdom. A core team of researchers from eight European institutes, each focusing on particular aspects of manufacturing, were selected to provide a holistic view on the subject. This group designed and conducted the Delphi survey. National partners from each of the 22 European countries provided support for the Delphi process in their own country. The survey was shaped by discussions in 22 national workshops involving 280 manufacturing experts from Europe and beyond with backgrounds in research, industry and public policy.

From Technologies to Working Conditions

Previous national and international studies on manufacturing industries focused on individual aspects of the manufacturing sector such as technology development or materials research. In contrast to this ManVis set out to develop more holistic visions of the future of production. The declared objective was to examine the widest possible spectrum of interests, not simply those of researchers but the interests of other

stakeholders as well. As a result the Delphi survey covered developments in all relevant aspects of manufacturing:

- Manufacturing technologies,
- Strategy,
- Organisation and management,
- Product features and concepts,
- Logistics and supply chain management, as well as
- Working conditions.

Enabling technologies for developments in all of these areas were examined. New demands for skills and competencies were deduced from the results and sustainability issues were a special focus throughout the project. Some statements in the Delphi questionnaire dealt with sector specific developments such as transport, machinery and traditional products.

Over 3,000 Experts Surveyed

The subsequent Delphi survey was conducted via an electronic questionnaire which was mailed to manufacturing experts – representatives from industry, research and policy in the 22 European countries listed above. Over 3,000 experts participated in the first round of the survey. The questionnaire was shortened for the second. Conflicting statements were regrouped and their first round results were presented jointly for re-consideration. A final project conference was held on October 24 and 25, 2005 in Bled, Slovenia. Entitled ‘European Manufacturing – Quo Vadis?’ the goal was to present the results of the Delphi and discuss its interpretation. The primary objective being to reflect on the development trends and visions that had been formulated, with help from manufacturing experts of different national and professional backgrounds. Discussions covered results and visions for the future of manufacturing as well as paths to secure the long-term competitiveness of the sector in Europe. A total of approximately 180 representatives from industry and academia as well as from European and national political institutions involved in the manufacturing industry participated in the conference.

Manufacturing Trajectories

Several possible trajectories for developments of the manufacturing of tomorrow came out of the ManVis findings:

- The struggle on **labour cost competition** will prevail in the years to come. Basically there are two dimensions to this. The loss of manufacturing operations to countries outside the European Union and movement within the European Union. The strategies that emerged from the ManVis expert consultation were mainly reactive. In other words they were based on cost reduction through automation and enhanced labour productivity. For the time being the New Member States will exploit a labour

cost advantage. However they will lose this faster than competitors outside Europe. Without their own capacity for innovation and for the absorption and enhancement of new technologies and practices, such foreign direct investment will pass through these Member States in as little as a decade. Both inside and outside Europe labour-cost competition will lead to a loss of employment in manufacturing.

- Recourse to **local manufacturing** operations and the promotion of excellence in local R+D reflected a generally reactive attitude to change. Often based on concepts originating from the ‘sustainable development’ debate this vision is characterized by local manufacturing operations and very close interaction with local users who still have purchasing power. The consulted manufacturing

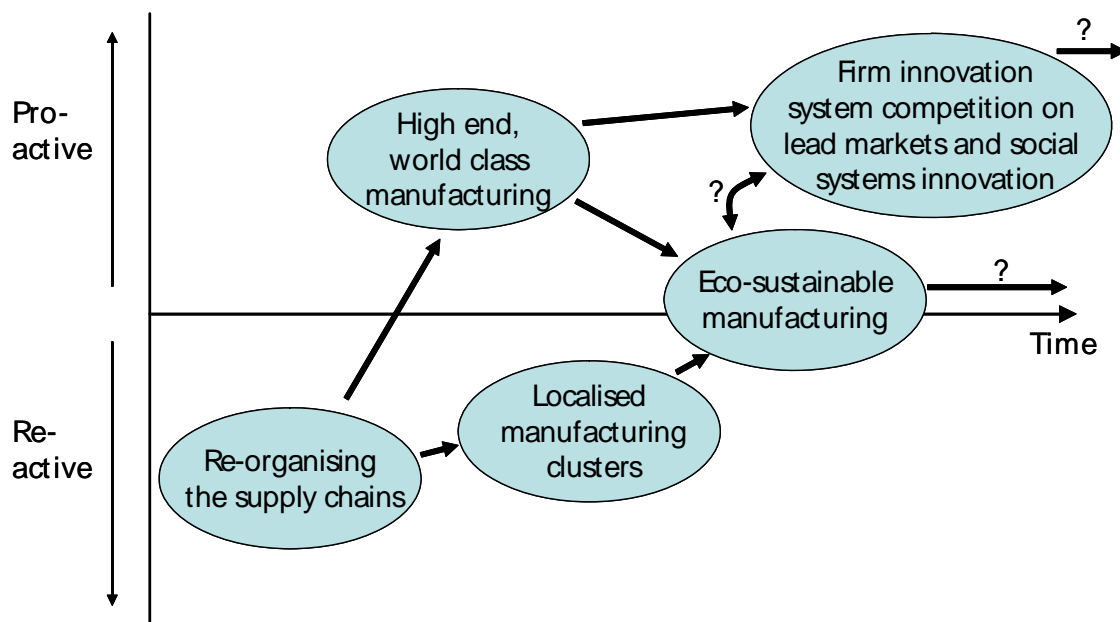
experts were quite sceptical on the prospects of this option because of their assessments on the weak ties of modern manufacturing to its environment. Other stakeholders however considered this concept as being both feasible and competitive.

- In the view of both experts and other stakeholders **eco-sustainable manufacturing** based on new products, new materials and energy efficiency as well as on advanced product service systems could be developed into a competitive advantage for Europe. Regulations that create demand pull as outlined in the FutMan policy scenarios for example could have a positive impact because of the excellent EU R+D position in this field.
- **High end manufacturing** will be based on the efficient use of sophisticated manufacturing technologies that will enable world class highly automated operations for new products. This lofty ambition will require exploitation of the EU capabilities in micro electro-mechanical systems and related nano-technologies. It will mean addressing gaps in automation and research on manufacturing with

new materials. Nevertheless this high efficiency approach will only reduce or maintain existing employment levels in European manufacturing.

- The most ambitious and far-reaching vision to emerge is that of European best practice in competing on the basis of the complete **firm level innovation system**. This view integrates user interaction with product design, development, production, supply chain, and logistics. The successful mastering of such 'systems' is considered the most promising way to ensure long-term competitiveness of the sector. Innovative and adaptive lead markets however must give European companies the chance to be the first to learn how to develop effective mechanisms for user-customer interaction to exploit this advantage.

Nonetheless high-end manufacturing with sophisticated technologies is a pre-requisite for any employment creating option.



Trajectories for Manufacturing Paradigms of Tomorrow

Safeguarding Jobs in the Manufacturing Sector

In order to move along these paths, create employment in EU manufacturing sectors a number of severe challenges must be addressed:

- Create manufacturing sectors that rely on sophisticated technology,
- Develop knowledge based, learning companies and industries,

- Compete on the basis of firm level innovation systems,
- Redefine demand and innovate through lead markets,
- Keep Europe economically united.

Because the science base in manufacturing is of growing importance, relevant topics and issues should be included in the funding mechanism of the planned European Science Council. Other existing mechanisms on the transfer and mobility of researchers have to be maintained and support provide for international cooperation.

In the view of the experts consulted, high-end manufacturing will not create new employment it will safeguard existing jobs and existing levels of employment. It is a necessary condition for the more advanced, employment creating trajectories. A successful strategy with high economic impact based on eco-sustainability will require not only high technology but the professional organisation of new product-service concepts.

More Research

Excellent research projects are needed to address the following challenges:

Paving the way for new technologies in manufacturing

- Roadmapping and foresight on manufacturing relevant nano- and (white) bio-technologies
- Measurement and workplace safety for nano-technology and bio-technology
- Applied basic research for white bio-technology and nano-manufacturing

Industrialising technologies

- Processing and manipulation of new materials
- Incorporating smart materials into components for process technologies
- Combining new materials incorporating micro electrical mechanical or adaptionic systems
- Exploring new knowledge for modelling and high power computing for the simulation of product development, material behaviour and virtual experiments

Exploiting technology advantages

- Micro-systems in machine tools and products
- Intelligent mechatronic systems for automation and robotics used for example in self adapting components
- New automation technologies using advanced man-machine interaction that accounts for diverse worker capabilities
- New ICT-tools for traditional manufacturing sectors

Technologies for customising products/services

- Tagging and labelling technologies
- Approaches to product customisation using software or electronic components that allow for maximum flexibility and user integration

- Technologies and concepts that facilitate user integration into innovation processes
- Technologies and concepts that facilitate personalisation and build to order concepts
- SME appropriate tools for networks and logistics

Enterprise Innovation Systems

It is important not to concentrate on technological developments alone but to consider the whole system of innovation in firms. This implies tools, strategies, methods and procedures for product development, logistics, innovation management and business concept development must be added to the technological research agenda. The main challenge towards more pro-active strategies lies in the implementation of successful learning companies which can quickly adapt their innovation system.

Enhanced funding mechanisms should focus on the integration of user-interaction mechanisms. Accompanying measures should ensure the transfer of R+D results by feeding them into other relevant policy processes such as standardisation and regulation as well as ensuring widespread dissemination.

A harmonized policy approach is absolutely necessary if the requirements or society and existing competences are to converge into a series of lead markets. First mover advantages can only be obtained if quick and decisive moves in the creation of demand and in the shaping and building of new competencies are made. In order to be successful a thorough analysis of long-term demand and the interactive participation of stakeholders and users will be decisive for actors in both public policy and industry. To close the loop exercising such practices in R+D projects and manufacturing efforts will be of crucial importance.

The concrete results of the ManVis Delphi survey are to be:

- Integrated into the long-term planning of the European research funding for manufacturing,
- Included in the debate on the Manufuture Technology Platform currently being developed and accessible at www.manufuture.org and
- Published and disseminated among potential users in government, industry and the general public.

Further Sources

This foresight brief provides a summary of the results of the overall ManVis project. More complete information, detailed results and policy recommendations can be downloaded at the project website www.manufacturing-visions.org.

About the EFMN: Policy Professionals dealing with RTD, Innovation and Economic Development increasingly recognize a need to base decisions on broadly based participative processes of deliberation and consultation with stakeholders. One of the most important tools they apply is FORESIGHT. The EFMN or European Foresight Monitoring Network supports policy professionals by monitoring and analyzing Foresight activities in the European Union, its neighbours and the world. The EFMN helps those involved in policy development to stay up to date on current practice in Foresight. It helps them to tap into a network of know-how and experience on issues related to the day to day design, management and execution of Foresight and Foresight related processes.