

This fiche is part of the wider roadmap for cross-cutting KETs activities

**'Cross-cutting KETs' activities bring together and integrate different KETs and reflect the interdisciplinary nature of technological development. They have the potential to lead to unforeseen advances and new markets, and are important contributors to new technological components or products.**

The complete roadmap for cross-cutting KETs activities can be downloaded from:

<http://ec.europa.eu/growth/industry/key-enabling-technologies/eu-actions/ro-ckets>

## Potential areas of industrial interest relevant for cross-cutting KETs in the Manufacturing and Automation domain



This innovation field is part of the wider roadmap for cross-cutting KETs activities developed within the framework of the RO-cKETs study. The roadmap for cross-cutting KETs activities identifies the potential innovation fields of industrial interest relevant for cross-cutting KETs in a broad range of industrial sectors relevant for the European economy.

The roadmap has been developed starting from actual market needs and industrial challenges in a broad range of industrial sectors relevant for the European economy. The roadmapping activity has focused on exploring potential innovation areas in terms of products, processes or services with respect to which the cross-fertilization between KETs can provide an added value, taking into account the main market drivers for each of those innovation areas as well as the societal and economic context in which they locate.

Taking the demand side as a starting point, cross-cutting KETs activities will in general include activities closer to market and applications. The study focused on identifying potential innovation areas of industrial interest implying Technology Readiness Levels of between 4 and 8.

## MA.1.2: Tools and concepts to process new and advanced materials

### Scope:

To develop new tools and concepts for precise and fast machining and processing of new and advanced materials, especially with respect to casting, forming, moulding, material removal, shaping, 3D printing, etc.

### Demand-side requirements (stemming from Societal Challenges) addressed:

Depending from the application or the type of processes used for production, manufacturing and automation can especially contribute to tackle the following societal challenges:

- Secure, clean and efficient energy
- Climate action, resource efficiency and raw materials

### Demand-side requirements (stemming from market needs) addressed:

- Provide for rapid and flexible production capabilities to match supply with volatile demand of today's rapidly changing markets
- Flexibly integrate design specifications into efficient operational routines by keeping a comparable throughput time in different configurations
- Provide for fast product/service systems able to combine rapid and flexible production capabilities with enhanced product design capabilities and exploit minimal distribution lead-times to match supply with volatile demand of today's rapidly changing markets
- Provide for the production of high-quality products
- Provide for the production of durable products
- Provide for alternative manufacturing approaches coping with the need of utilizing new and advanced materials in products, adding functionalities to products, dealing with complex structures and shapes

### Specific technical/industrial challenges (mainly resulting from gaps in technological capacities):

- High productivity and "self-assembly" technologies development of conventional (joining, forming, machining) and new micro/nano-manufacturing processes
- Development of micro-electromechanical systems (MEMS) for computer controlled deposition and curing of radiation-curable materials and for embedded (micro) sensors
- Development of high throughput processes (e.g. extrusion, forming, casting, coating and quick sintering) able to produce net-shape or semi-finished products as well as coatings, using nanotechnologies and nanomaterials
- Development of new process technologies to support casting, material removing and forming processes when applied to new materials, considering lifecycle impacts as well as the performance requirements for these processes (e.g. roughness, accuracy, robustness)
- Development of tailor-made solutions in the field of fibre-based structures and high value-added net- or near-net-shaped 3D products, produced at varying volumes
- Manufacturing of products such as Organic Light-Emitting Diodes (OLED) for lighting, displays and technical textiles, organic photovoltaics, organic sensor arrays using new organic functional polymers and hybrid materials
- Development of manufacturing processes for advanced energy systems optimizing the performance of the materials used for their construction and for functional purposes

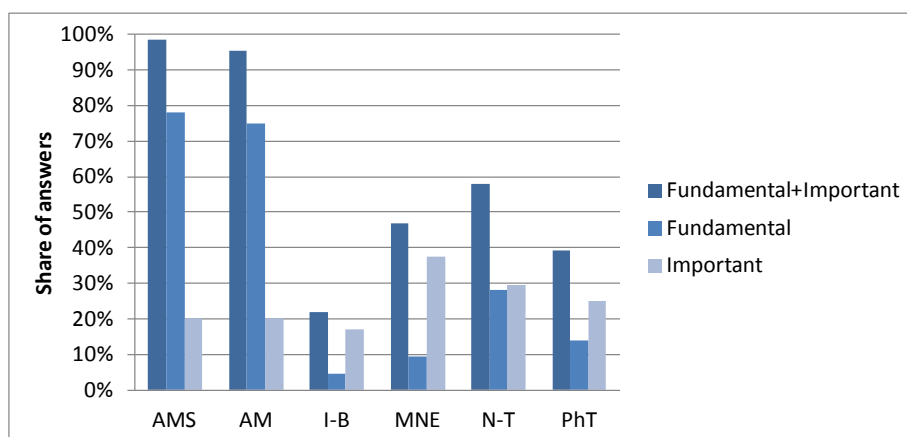
### Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of new tools and concepts for precise and fast machining and processing of new and advanced materials, building on solutions such as "self-assembly", micro-electromechanical systems (MEMS) for computer controlled deposition, traditional and new fine output processes (e.g. extrusion, forming, casting, coating and quick sintering), tailor-made solutions in the field of fibre-based structures, high value-added net- or near-net-shaped 3D products, etc.

To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this

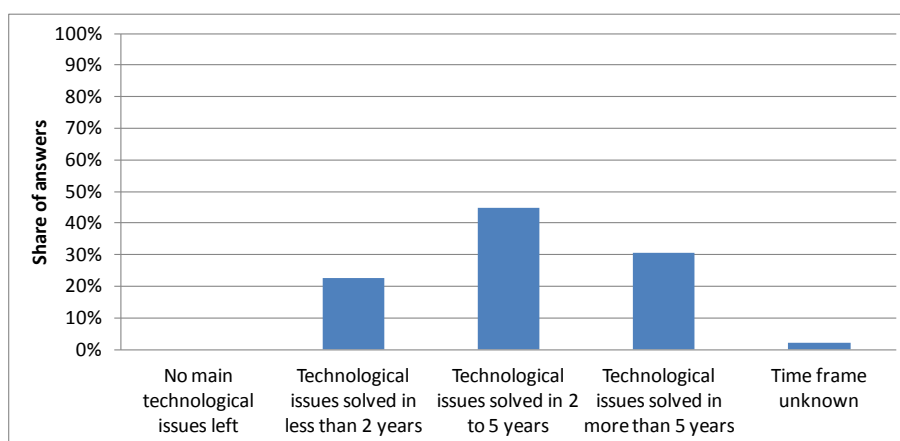
Innovation Field, and desk research activities, have allowed identifying a rather strong interaction of KETs with respect to this Innovation Field, with either fundamental or important contribution mainly by the following KETs:

- Advanced Manufacturing Systems (AMS)
- Advanced Materials (AM)
- Micro- and Nano-Electronics (MNE)
- Nanotechnologies (N-T)
- Photonics (PhT)



#### Timing for implementation:

According to the majority of KETs experts' opinions (whose result is depicted in the below bar chart), desk research, and in line with the KETs-related patenting activity in this field, it is considered that the main technological issues holding back the achievement of cross-cutting KETs based products related to this Innovation Field could be solved in a time frame of 2 to 5 years:



Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the short term should be taken into consideration within this framework.

#### Additional information according to results of assessment:

##### ➤ **Impact assessment:**

- In 2010, the production of machine tools in Europe accounted to 16.6 billion Euro and was stable compared to 2009, but significantly lower than 24.4 billion Euro posted in record 2008. The production of the sector is highly concentrated in Germany and Italy, which accounted together for two thirds of 2010's output. The other significant producers with share in the total output higher than 3% are Switzerland, Austria and Spain.

- Being a provider of purely investment goods, the machine tool industry is a cyclical business. All the fluctuations in the general economy are immediately reflected in the investment goods sector, but with increased magnitude. Customers tend to postpone investment decisions during economic downturns and they increase their spending on new production equipment during upturns. The machine tool industry is usually the first to be affected by economic recessions, as the first reaction of customers is to cut budget in capital expenditures.
- Europe has borne witness to a radical shift of machine tool consumption to developing countries over the last decade. The global economic crisis has further accelerated this trend. Europe represented three quarters of the world consumption of machine tools at the turn of the century, whereas today Asia has taken over this share and Europe's share dropped to one quarter of world consumption. Asia is forecasted to maintain this share whilst consumption will grow even further. Today, 79% of European machine tool production is exported and 62% of these exports go to non-CECIMO countries. All important business opportunities for European manufacturers are and will be outside Europe.
- Source: [www.cecimo.eu](http://www.cecimo.eu)

➤ **Results of patents scenario analysis:**

- 38 839 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- The very high number of patents identified within this framework depends from the openness of the field, which renders the use of patent-related indicators to provide for the evaluation of trends non-reliable in this case.