European Commission

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.1.5: Integrated non-conventional processes to reduce manufacturing time to market and increase the quality on the workpiece

Scope:

Integration of non-conventional technologies (such as lasers, waterjet, electro discharge, ultrasonic, printing, 3D printing) to develop new multifunctional manufacturing processes (for inspection, thermal treatment, stress relieving, machining, joining, etc.) that reduce time to market and increase quality.

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):

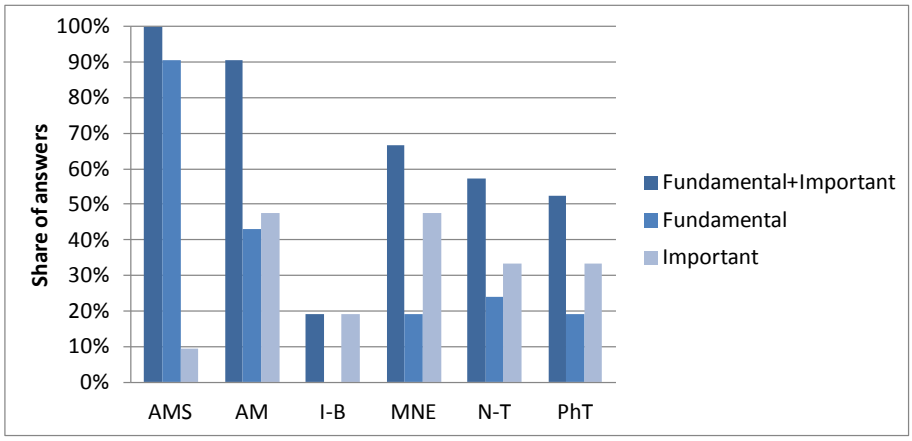
- Development of new and innovative technologies aiming at increasing the reliability and reproducibility of smart composites and metallics, and for further integration of functions
- Integration of non-conventional technologies (e.g. lasers, waterjet, electro discharge machining, ultrasonic, printing) towards the development of new multifunctional manufacturing processes (including in process concept: inspection, thermal treatment, stress relieving, machining, joining)

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of integrated non-conventional processes to reduce manufacturing time to market and increase the quality on the workpiece, thanks to the development and integration of non-conventional technologies (e.g. lasers, waterjet, electro-discharge machining, ultrasonic, printing) and of new multifunctional manufacturing processes (including in process concepts: inspection, thermal treatment, stress relieving, machining, joining).

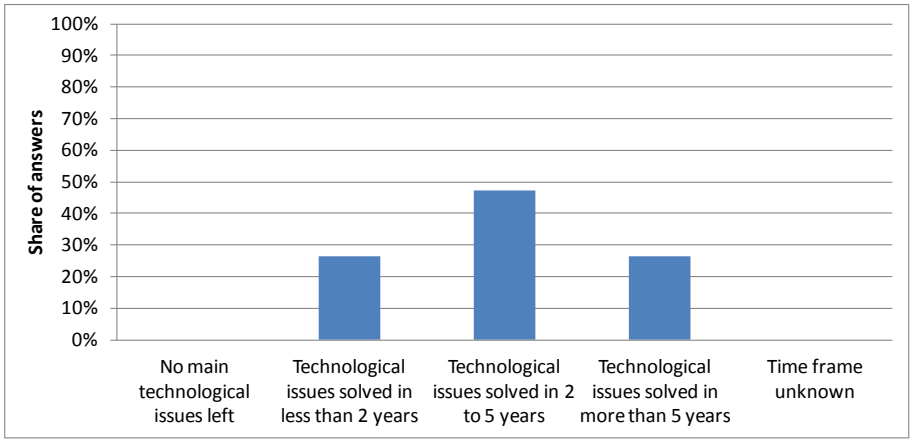
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong 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, yet consensus by experts indicates also both shorter and greater periods being necessary:



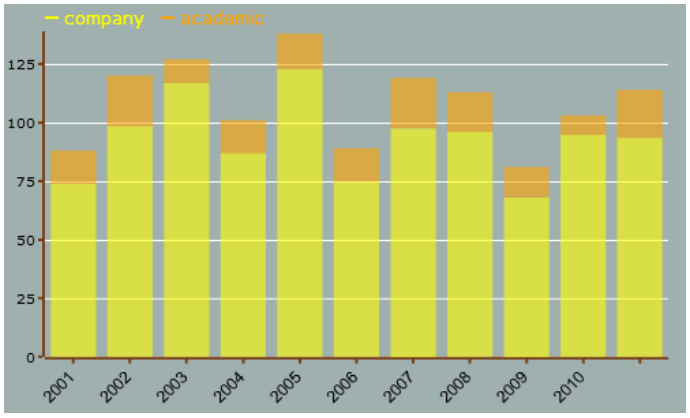
Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the short term should be taken into consideration within this framework.

Additional information according to results of assessment:

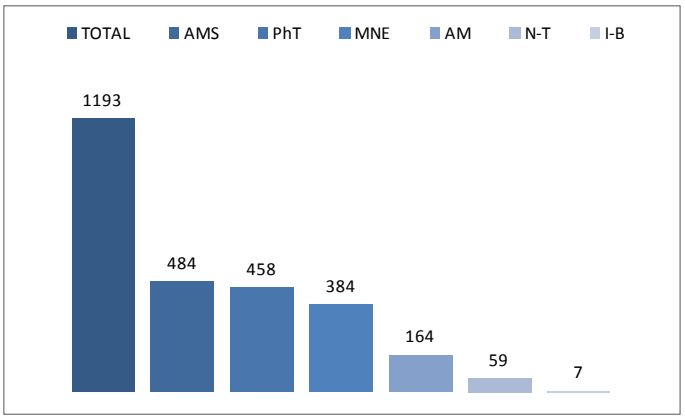
- ***Impact assessment:***
  - Introduction in conventional manufacturing of non-conventional highly performing technologies (e.g. lasers, waterjet, electro-discharge, ultrasonic, printing, 3D printing) has several times been driven by the need to increase quality of the work pieces or the need to reduce time to market in manufacturing.
  - Despite the initial investments to provide for the new equipment and manufacturing infrastructures, gains in precision, reflecting in higher product quality and reduced scraps, and/or in the production rate, reflecting in higher productivity, have several times well justified the initial investment in the manufacturing sector.
  - In addition, the capability of the manufacturing industry to be as responsive as possible in satisfying customer needs is a great advantage of manufacturing methods capitalizing on non-conventional highly performing technologies.
  - Several are the operations in manufacturing that have already benefitted and that could still benefit from the introduction of non-conventional technologies. These include, among others, inspection, thermal treatment, stress relieving, machining, joining, etc.

➢ ***Results of patents scenario analysis:***

- 1193 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Oscillating trend curve (number of patents per year)
- Highest share of industrial applicants:



- Patents by KET(s):

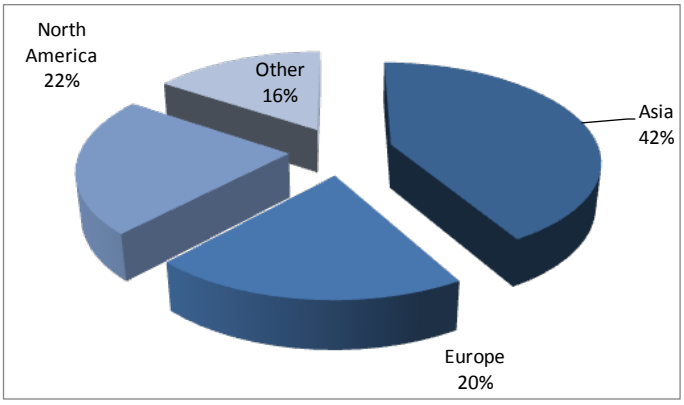


- Patents by KET(s) and relevant combinations of KETs:

KET(s)	*Number of patents*
AM	164
AM / MNE	25
AM / MNE / N-T	8
AM / MNE / N-T / PhT	4
AM / MNE / PhT	9
AM / N-T	24
AM / N-T / PhT	4
AM / PhT	11
AMS	484
AMS / AM	17
AMS / AM / MNE	2
AMS / AM / MNE / PhT	2
AMS / AM / PhT	2
AMS / MNE	82
AMS / MNE / PhT	23
AMS / N-T	2

KET(s)	*Number of patents*
AMS / N-T / PhT	1
AMS / PhT	72
IBT	7
MNE	384
MNE / N-T	22
MNE / N-T / PhT	12
MNE / PhT	142
N-T	59
N-T / PhT	21
PhT	458

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection: