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 Mining, Quarrying and Extraction 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.

MI.1.1: Non-invasive exploration technologies for cost-efficient underground resource detection and definition

Scope:

To develop improved non-invasive exploration technologies, such as ground penetrating radars, 3D and 4D seismic prospecting, hyperspectral imaging, Measuring While Drilling (MWD) techniques, and other geophysical technologies, are needed for more cost-efficient and environment-friendly exploration aimed at the detection and definition of underground resources (i.e. oil, gas, mineral as well as water resources).

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

- Tackle the “Climate action, resource efficiency and raw materials” societal challenge

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

- Secure the supply of raw materials and resources
- Reduce field operating costs while ensuring safety and decreasing environmental impacts
- Enable more efficient and sustainable resources utilisation
- Enhance productivity of mining, quarrying and other extractive activities
- Improve environmental management in mining, quarrying and other extractive activities
- Guarantee adequate waste management

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

- Improvement of non-destructive exploration technologies to detect underground resources, including ground penetrating radars, 3D and 4D seismic prospecting, hyperspectral imaging, and other geophysical technologies that make excavating not necessary
- Improvement of sensing while sampling techniques, e.g. Measuring While Drilling (MWD)

Contribution by cross-cutting Key Enabling Technologies:

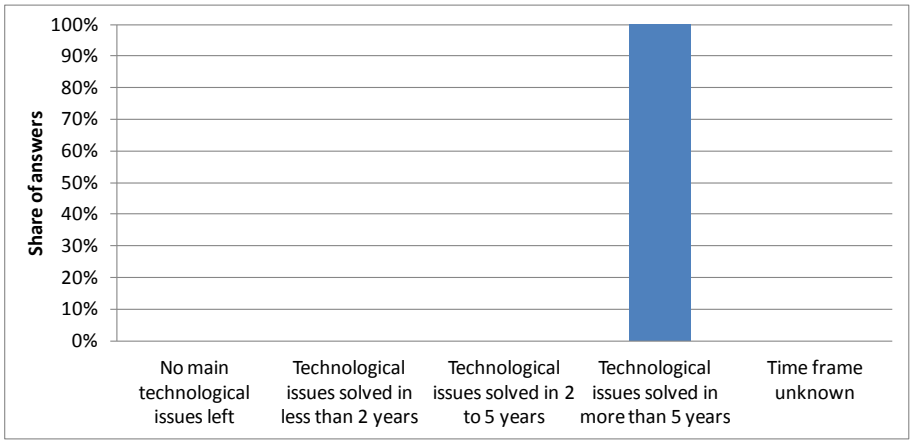
In respect to this Innovation Field, the integration of KETs could contribute to the development of improved non-invasive exploration technologies, such as ground penetrating radars, 3D and 4D seismic prospecting, hyperspectral imaging, as well as sensing while sampling techniques.

To this aim, the combination of KETs experts’ opinions collected through the dedicated survey, 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:

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

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 more than 5 years:

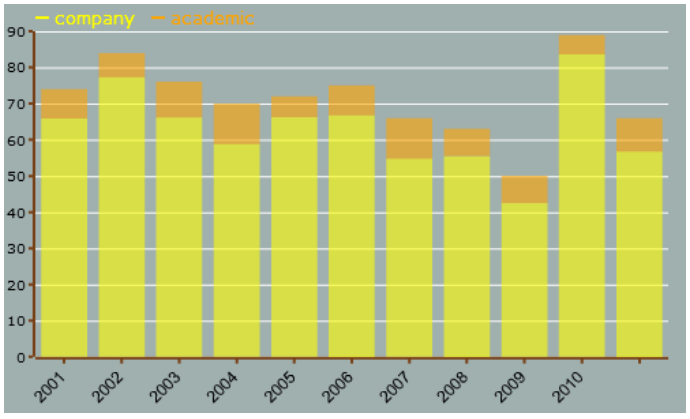


Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the medium term should be taken into consideration within this framework.

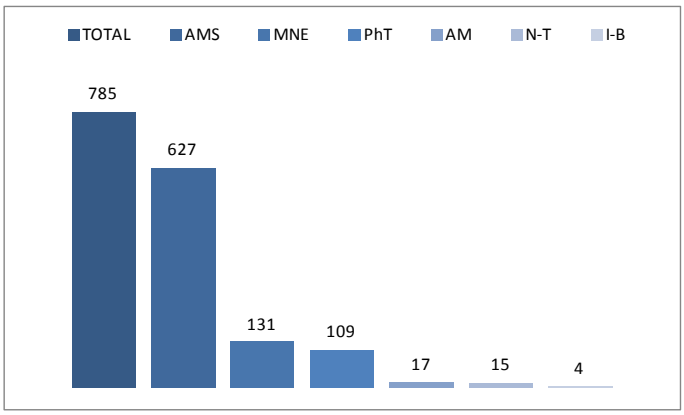
Additional information according to results of assessment:

- ***Impact assessment:***
  - According to Frost & Sullivan, the demand for enhanced safety standards and for increased energy efficiency, together with technological improvements in monitoring and process control, will support growth in the European mining machinery market. The report 'Analysis of the European Mining Machinery Market' finds that the market earned revenues of 2 billion Euro in 2011, and estimates this to reach 2.5 billion Euro in 2016. The market research covers underground mining, surface mining and mineral processing equipment (Source: Frost & Sullivan, Analysis of the European Mining Machinery Market, 2012).

- ***Results of patents scenario analysis:***
  - 785 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
  - Stable trend curve (number of patents per year)
  - Highest share of industrial applicants:



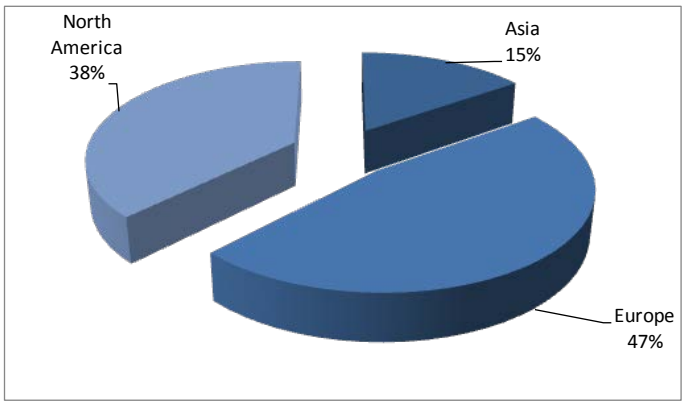
- Patents by KET(s):



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

KET(s)	*Number of patents*
AM	17
AM / MNE	1
AM / MNE / N-T	1
AM / MNE / N-T / PhT	1
AM / MNE / PhT	1
AM / N-T	1
AM / N-T / PhT	1
AM / PhT	1
AMS	627
AMS / AM	3
AMS / MNE	27
AMS / MNE / N-T	1
AMS / MNE / PhT	12
AMS / N-T	4
AMS / PhT	32
IBT	4
MNE	131
MNE / N-T	7
MNE / N-T / PhT	1
MNE / PhT	57
N-T	15
N-T / PhT	1
PhT	109

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection: