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 Electronics and Communication Systems 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.

E&C.2.4: Lightweight vehicle embedded circuits and systems

Scope:

To develop electronic components and circuits adapted to (and qualified for) the specific constraints of vehicle embedded systems: lightweight and energy efficient, modular (as much as possible) and easily upgraded/retrofitted, resistant/resilient to vibrations and other operational constraints (dynamics, temperature, etc.), long campaign life and fit for architectures offering the best operational safety.

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

- "Innovative and reflective societies" and a competitive European economy need breakthrough innovations, smart capabilities or high performance, a large part of which will be made possible by improved or even radically new electronics components and circuits
- Energy and material resources efficiency are demanding much from electronic components, be it direct energy consumption reduction, advanced power management, low use of critical materials, recyclability, miniaturization, etc.
- Large areas monitoring – as for agriculture, forestry, marine resources, water resources, pollution monitoring, homeland security, etc. – require "smartification" of the environment, e.g. with high autonomy ubiquitous low cost sensing and communication capabilities, serviced by new components, circuits and architectures
- High value systems for energy, transport, health care as well as some industrial, space or military applications need components and circuits for highly demanding applications, severe vibration or temperature environments, high computing power, specific reliabilities, real time operations, miniaturization, upgrade/retrofit,etc.
- Electronic components being a basic bricks for all high added-value systems, maintaining an electronics industry in Europe is a critical matter of strategic non-dependence

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

- Electronics industry is a highly competitive market integrated into global value chains, with short cycles and requiring large investments. Keeping caught-up with Moore's law (computing power doubles every two years) as well as with new trends (non-computing capabilities grouped under the "More-than-Moore" concept) is a survival issue for the European electronics industry facing huge global competition
- With electronic and telecommunication systems getting more and more complex, developing circuits and components dedicated to a specific application is a key for competitiveness of entire industries. Industrial eco-systems in consumer or professional electronics require strong interactions with the components and circuits link
- Setting up the "Internet of Things", "Cloud computing" or "Big data" services are major requirements from many industries and services in Europe. It requires developments in components as well as from upper technical layers
- Cost is a key and all components design and production has to integrate competitive production aspects from the earliest phase

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

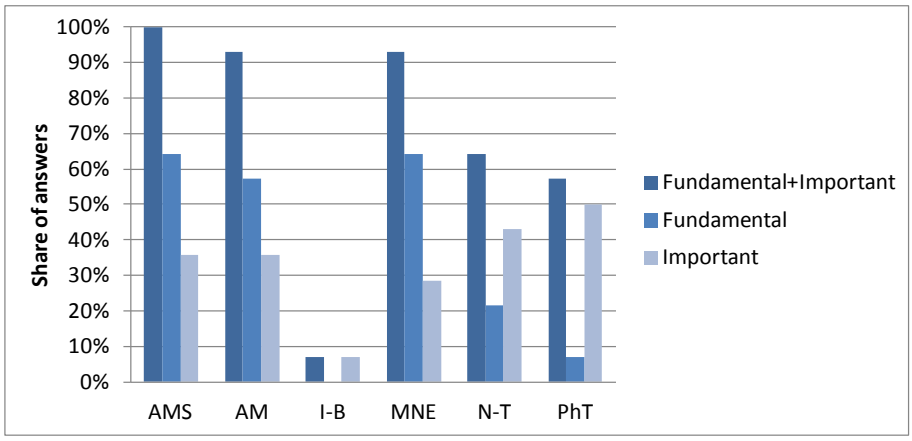
- Increase of the usability of standard "off the shelf" components in embedded systems, including through virtualizing demanding processes / relying on external system intelligence
- Support of incremental and modular evolution of the systems, taking into account life expectancy, obsolescence and upgrade of the components
- Development of safe and secure broadband wireless communications between subsystems
- Development of new integrated open, distributed and performing architectures (including through optic fibre networks)
- Reduction of weight and energy consumption of displays and other human machine interfaces
- Reduction of embedded electronics power consumption
- Reduction of embedded electronics weight through miniaturization and packaging improvement, facing issues on reliability, radiation shielding and heat dissipation

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of more advanced electronic components and circuits adapted and qualified for vehicle embedded systems, through miniaturization, exploitation of wireless communications, energy efficiency, incremental and modular evolution; systems have to take into account life expectancy, obsolescence and need for upgrade of the components, resistance / resilience to vibrations, dynamics, temperature and safety.

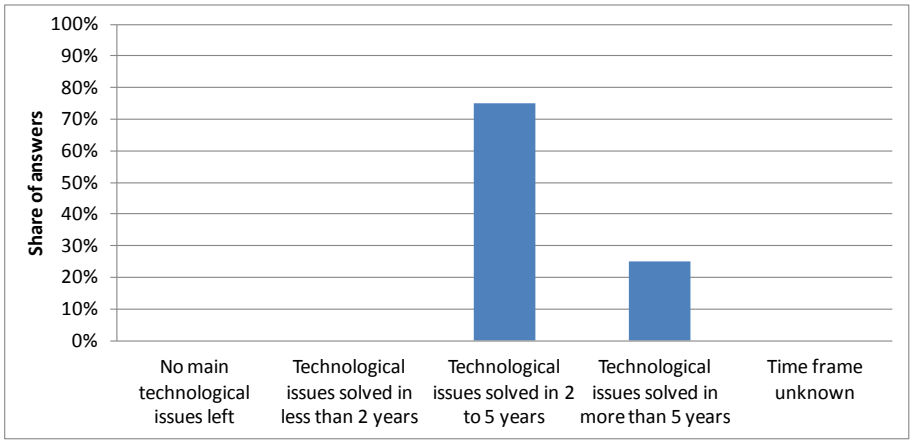
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong interaction of KETs with respect to this Innovation Field, with either fundamental or important contribution mainly by the following KETs:

- Advanced Manufacturing Systems (AMS)
- Micro- and Nano-Electronics (MNE)
- Advanced Materials (AM)
- Nanotechnologies (N-T) and Photonics (PhT), with a less fundamental input



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:

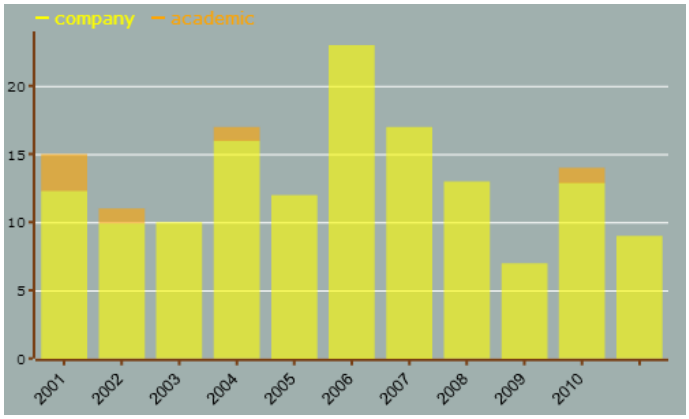


Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the short term should be taken into consideration within this framework.

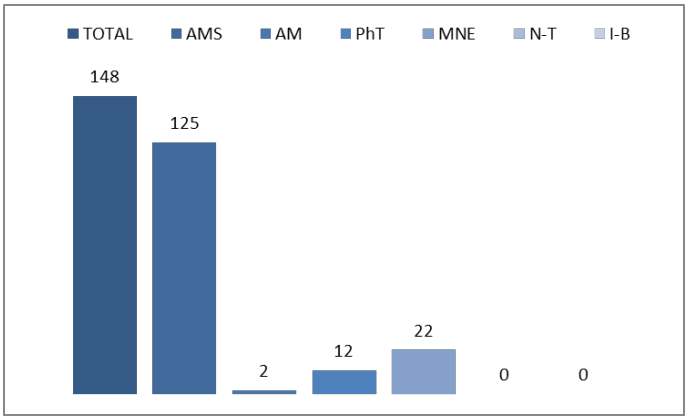
Additional information according to results of assessment:

- ***Impact assessment:***
  - Avionics typically represents only a few % of the total aircraft flying mass and is even lower in other types of vehicles. Nevertheless, with more and more electric systems on board, up to "full electric" including propulsion, that share of total vehicle weight is deemed to increase. Since flying weight is always direct energy consumption, minimizing the weight of embedded electronics is a matter of cost and environment efficiency (and of vehicle autonomy and range as well).
  - There is also a safety aspect to consider, since vehicle embedded circuits have to successfully face, whatever the conditions, specific constraints as vibration and vehicle dynamics, electromagnetic radiations from other vehicle circuits or passenger and crew personal devices in the enclosed Faraday cage of vehicle's structures, temperature changes, dust, etc. Increased safety levels typically means increasing protection from packaging, which has a direct weight cost. Working out lower weight components, circuits and architectures will reduce the pressure on the weight versus safety balance.
  - Europe is in a leading position in transport electronics and there is a direct beneficial cross-fertilization effect in supporting consolidated eco-system links between the European electronics and transport industries.
  - Last but not least, working out low weight electronics means working out materials, increase overall resource efficiency, including or critical resources, and provide opportunities for better recyclability.

- ***Results of patents scenario analysis:***
  - 148 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
  - Quite stable trend curve (number of patents per year), had a peak around 2006
  - Highest almost exclusive share of industrial applicants:



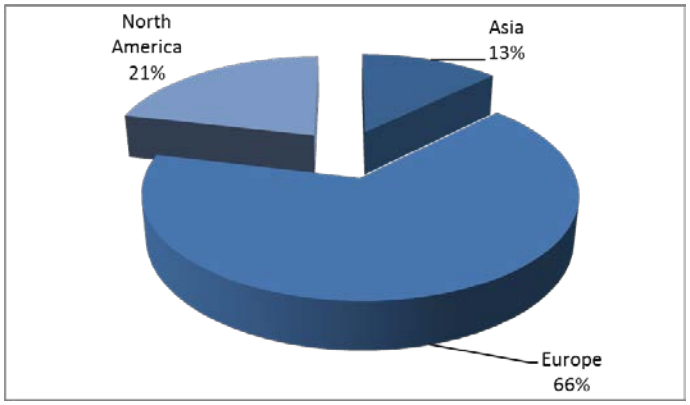
  - Patents by KET(s):



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

KET(s)	*Number of patents*
AM	2
AMS	125
AMS / AM	1
AMS / MNE	4
AMS / PhT	3
MNE	22
MNE / PhT	5
PhT	12

- Patent distribution by (Applicant) organization geographical zone:
- German players, mainly from the automotive industry, dominate patent application in this field.



- Patent distribution by geographical zone of priority protection: