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 Transport and Mobility 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.

T.4.1: Information-rich operator position

Scope:

In the context where information capture is increased all over the transport chain (on-board vehicles, from the infrastructure or any other source), as well as multilateral communications (vehicle-to-vehicle, vehicle-to-infrastructure), the provision of the vehicle operator – pilot, driver, sailor, traffic controller, etc. – with full situational awareness and decision-making assistance is getting fundamental. Taking stock on advanced processing capabilities, advanced ergonomics and optimal human machine interfaces, the information-rich operator position supports safer, more efficient, more automated and foolproof vehicle operations.

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

- Tackle the "Smart, green and integrated transport" societal challenge
- Contribute to the achievement of the EU Transport 2050 strategy (COM/2011/0144 final) objective of a 60% reduction of CO_2 emissions from transports
- Deliver safer and less congested travel as well as smoother and quicker journeys, as requested for the Trans European Transport Network (TEN-T) policy (Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 and repealing Decision No 661/2010/EU Text with EEA relevance)
- Achieve SESAR 2020 objectives for the European Air Traffic management, as regards environment (emissions and local nuisances), safety and ability to efficiently cope with growing traffic volumes
- Continuously enhance safety and resistance/resilience of vehicle operation all along end-to-end transport chains
- Support the Smart Vehicle initiative of the i2010 strategic framework on the innovation society (COM(2005) 229 final)
- Ensure operational implementation of European international transport agreements (as TRACECA, SEETO and NDPTL)

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

- Reduce traffic management direct (fees for operators) and indirect (such as costs of jams on citizen health, economy competitiveness, environment, etc.) operational costs
- Reduce or maintain numbers and rates of accidents in Europe at an acceptable number, whatever traffic growth
- Enable new transportation services dealing with changing mobility and transportation needs, changing trade patterns, citizen request for affordable, timely, seamless and ubiquitous transport services
- Support integration of lean global logistic chains taking advantage of communication and tracking technologies for preventing incidents and offering in-trip services

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

- Development of an open, scalable and resilient electronic architecture able to collect useful external and vehicle information and make it available to processing systems
- Improve and widely rely on vehicle-to-vehicle, vehicle-to-infrastructure and vehicle-to-road communication to optimize vehicle-infrastructure-user co-modal working
- Extension of the use of synthetic vision means merging com/nav information, visual and oral clues, vehicle status, load surveillance, etc. so as to provide operators with context-based operational assistance
- Spread use of glass displays for all sorts and sizes of vehicles and crews
- Integration of multi-channel HMI (audio, visual, olfactory, haptic) supported by an improved understanding of human behaviour and performance and the capability to adapt the interface to the particular user
- Increase of crew and staff situational awareness and event anticipation, and provide them with assisted decision-making systems
- Take advantage of cognitive and learning processes, sense & avoid capabilities and other artificial intelligence concepts to reduce requirements on unnecessary/routine human actions
- Reduction of crew workload through increased automation and virtualization

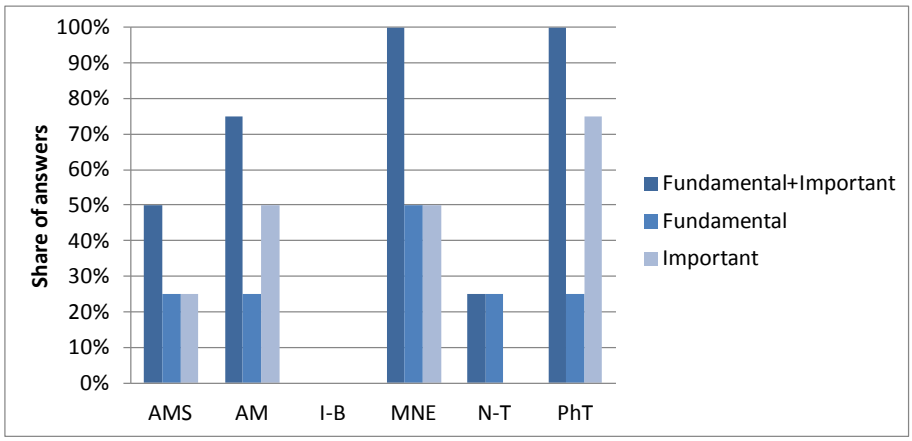
- Achievement of an effective level of operator's activity monitoring by detecting in real time overload, fatigue, stress, ill-health and other degradation of vigilance (including incapacitation due to breaches in security)
- Implementation of operational capability for minimization of human error and mitigation of the consequences
- Development of advanced low cost training systems for operators (simulators, etc.)
- Safely and efficiently provide personal / recreational vehicle operator with safety alarms, navigation and parking assistance, tourism information and other services based on context-awareness (including for behavioural change)
- Development of cheap foolproof and safe communication and identification equipment for recreational vehicles
- Progressive development and implementation of acceptable levels of automatic intervention on vehicle dynamics and controls according to its specific situation, location, events and/or operator status

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of advanced solutions allowing the vehicle operator or the crew to have full situational awareness and decision-making assistance as well as a reduction of workload through increased automation and virtualization, taking stock on solutions such as enhanced human machine interfaces and open, scalable and resilient electronic architectures able to improve vehicle-to-vehicle, vehicle-to-infrastructure and vehicle-to-road communication and to detect in real time overload, fatigue, stress, ill-health and degradation of vigilance.

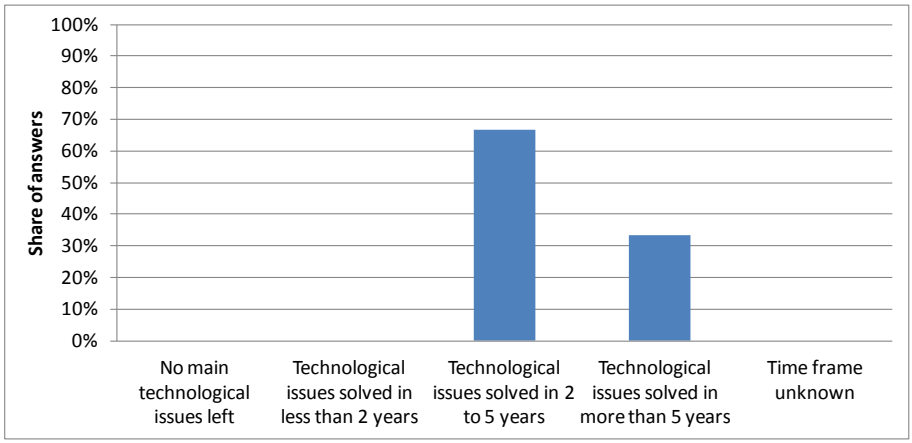
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong 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)
- Photonics (PhT)



Timing for implementation:

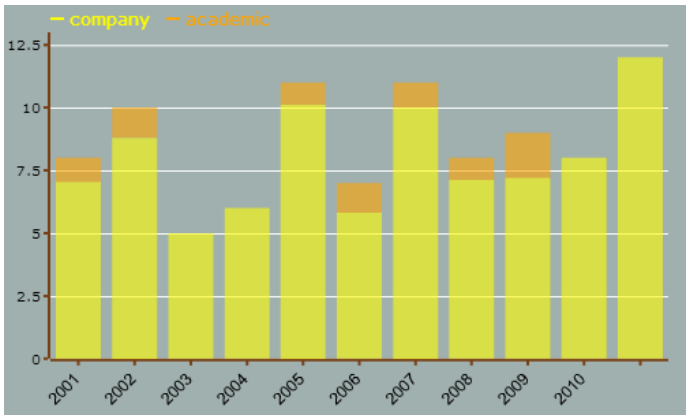
According to the majority of KETs experts' opinions (whose result is depicted in the below bar chart), desk research, and in line with the KETs-related patenting activity in this field, it is considered that the main technological issues holding back the achievement of cross-cutting KETs based products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



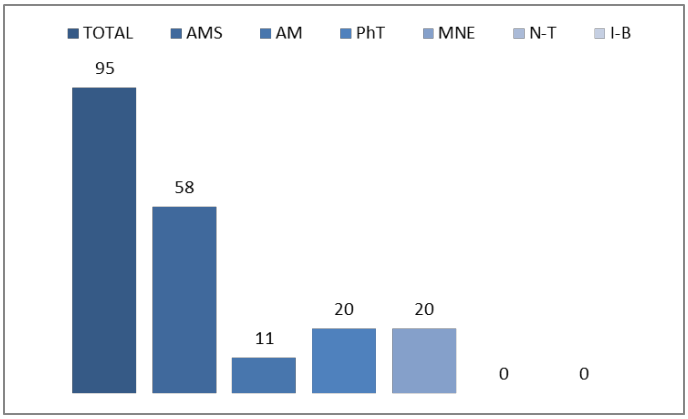
Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the short term should be taken into consideration within this framework.

Additional information according to results of assessment:

- ***Impact assessment:***
  - In the defence sector, a strong development of autonomous vehicles has been going on in the past years, particularly to provide the operator with full situational awareness and decision-making assistance and support safe, efficient, automated and foolproof operations. Such capability could be useful also for many different civilian applications, thus it could be adapted for vehicle-to-vehicle or vehicle-to-infrastructure communications.
  - Most studies about transport accident reports consider that human errors contribute to around 80% of rail, air or waterborne transport, up to 90% for individual road transport. This seems quite stable in time, since the 1977 Treat & al. study already found that human error was the sole cause in 57% of all accidents and was a contributing factor in over 90%). Nevertheless just sticking to that share is already not automatic since traffic regularly grows in all modes of transport and machine failures are on a decreasing trend. Within a more and more complex operational environment, providing “operators” with more and better information is a key for reducing or keeping under control that human factor.
  - Better operator assistance is also of energetic, environmental and economic interest, as it can participate to traffic regulation, propose alternative paths to busy axes, promote an eco-responsible way of driving, inform on temporary regulations due to climate events or pollution peaks, deliver a warning in case of excessive speed, etc. Fuel-efficient driving can reduce consumption by as much as 6%.
  - An information-rich environment also has the potential to reduce vehicle crew workload, enabling better vigilance, better decision-making, better anticipation of possible events and feasibility of additional tasks related to new functionalities or services (e.g. preparing ground load/unload or maintenance activities while in cruise, communication with passengers, touristic or practical information research, etc.).
  - Finally, the opportunity of further developing vehicle-to-operator interface is a step forward toward the longer-term autonomous human transport.
- ***Results of patents scenario analysis:***
  - 95 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
  - Stable or slightly increasing trend curve (number of patents per year)
  - Highest share of industrial applicants:



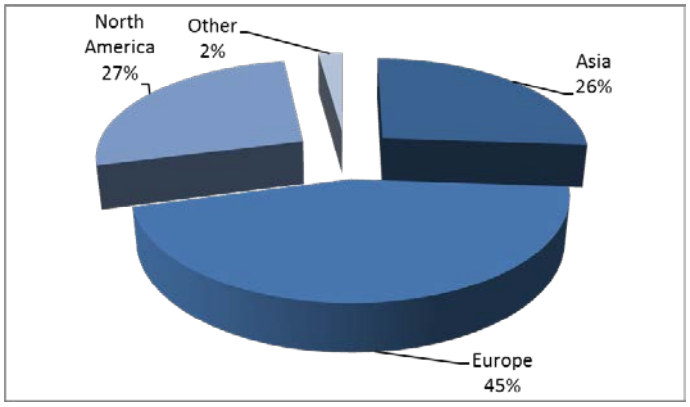
- Patents by KET(s):



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

KET(s)	*Number of patents*
AM	11
AMS	58
AMS / AM	1
AMS / MNE	4
AMS / MNE / PhT	1
AMS / PhT	1
MNE	20
MNE / PhT	9
PhT	20

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection: