Potential areas of industrial interest relevant for cross-cutting KETs in the Environment 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.

EV.2.1: Satellite- or drone-based Earth observation for meteorology, environment monitoring and other wide area services

Scope:

Satellite or drone-based Earth observation systems for meteorology, environment monitoring, land exploration and other wide area services including homeland surveillance.

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

- Tackle the "climate action, resource efficiency and raw materials" challenge, indirectly also contributing to address challenges such as "food security, sustainable agriculture, marine and maritime research and the bio-economy" and "health, demographic change and wellbeing"

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

- Manage environmental hazards and pollution
- Ensure health and safety of people including through managing environmental pollution
- Ensure health and safety of people including through managing environmental hazards

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

- Increase of the resolution and observation range of on-board Earth observation sensors and sensing systems
- Optimization of data chains, from generation to processing, compression, storage and transmission, so as to reduce resource use and increase security and dependability
- Setup of cost-effective versatile satellite and constellation architectures adapted to changing missions
- Development of enablers for Earth Observation satellite constellation, including launching, positioning and station keeping capabilities, inter-satellite links and related ground segment facilities
- Enabling of simulations and data processing by supercomputing
- Especially for drone-based observation systems, improvement of human-machine interfaces, improvement of the robustness of robotic systems and architectures (including through the development and integration of lightweight, high strength materials and the development of advanced integrated mechatronic systems), improvement of energy systems (including through the development of low weight power sources and through improved power management solutions), enhancement of locomotion efficiency,

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of advanced wide area observation systems based on satellites or drones, building on the increased resolution of on-board sensors and observation systems, the enhancement of the communicative interaction between robotic systems, improved user interfaces, the further miniaturization and integration of actuators, sensors, control and energy systems.

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:

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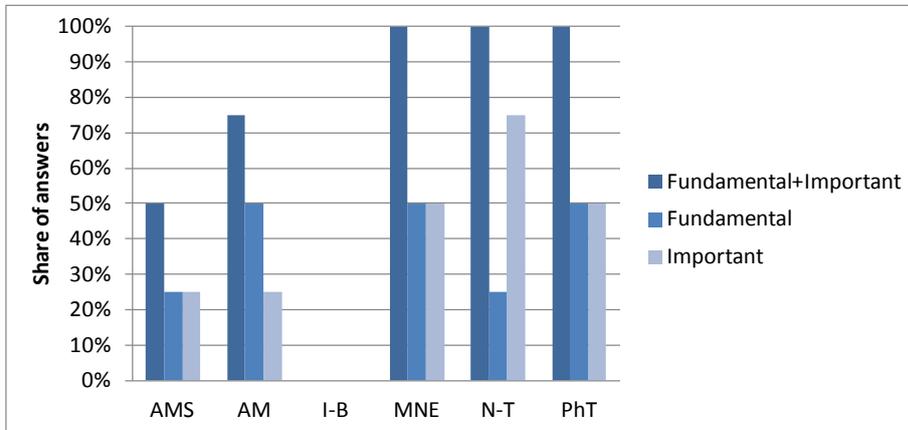
Timing for implementation:

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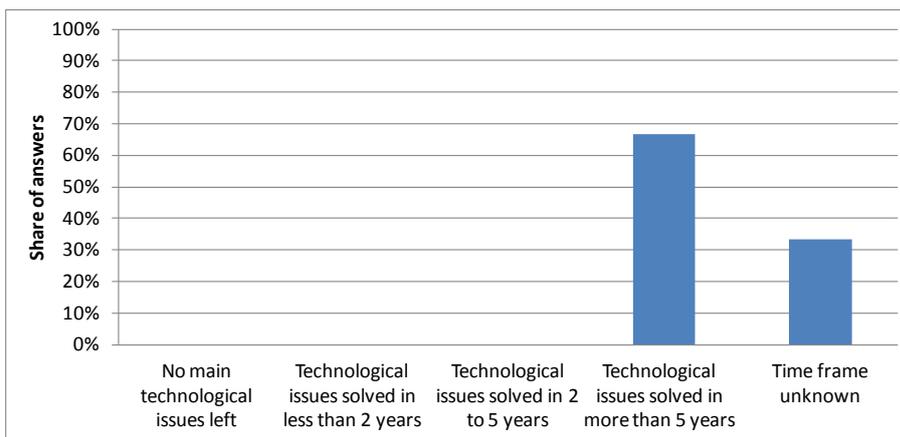
Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the medium term should be taken into consideration within this framework.

Additional information according to results of assessment:

➢ *Impact assessment:*

- The Global Satellite-based Earth Observation market will grow at a compound annual growth rate (CAGR) of 11.34% over the period 2013-2018. One of the major trends witnessed in the market is the formation of the GEOSS. GEOSS is an internet-based platform that allows users of Earth observation data to access, search, and use the data, information, tools, and services for their needs. GEOSS is mainly used to develop a data-driven system to investigate the Earth's past, present, and future scenarios and models. In addition, GEOSS is expected to address societal benefit areas of critical importance such as disaster, climate, water, weather, ecosystem, agriculture, biodiversity, health, and energy. GEOSS was developed by the GEO, a voluntary partnership of governments and international organizations, to utilize the growing potential of Earth observation. The GEO has been coordinating efforts to build GEOSS on the basis of a 10-year implementation plan. The GEOSS system is expected to be completed by 2015. Therefore, the formation of GEOSS is an emerging trend that is expected to have a positive influence on the growth of the market during the forecast period.

- According to the report "*Global Satellite-based Earth Observation Market 2014-2018*", one of the main drivers in this market is the increasing number of Earth observation satellites being launched. Seven Earth observation satellites were launched between January 2013 and October 2013. In addition,

almost 30 Earth observation satellite missions are expected to be launched November 2013-December 2014, and almost 258 Earth observation satellites are expected to be launched during 2014-2029.

- Further, the report states that one of the major challenges in the market is the increasing adoption of UAV-based Earth observation. Many defence organizations as well as natural resources and biodiversity researchers, are using UAVs to gather information and imagery, because the UAVs provide more flexibility and hyper-spatial data compared to the satellite-based Earth Observation data.
- Source: Research and Markets, Global Satellite-based Earth Observation Market 2014-2018, 2014

➢ *Results of patents scenario analysis:*
- No significant patent-related indicators can be reported in this field