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 Health and Healthcare 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.

H.3.1: Robots supporting professional care

Scope:

To develop improved robotic systems supporting healthcare workers either within the setting of a hospital or a patient's home in patients' monitoring and care activities (e.g. logistical robotized aids for nurses, robotized patient monitoring systems, automated medicine delivery to patients, and other robotized physical tasks in care provision or paramedic tasks).

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

- Tackle the "health, demographic change and wellbeing" societal challenge

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

- Decrease costs of care provision or paramedic tasks

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

- Creation of robotic platform technologies to enhance standardization and cooperation
- Creation of open design and simulation systems to jointly develop new robotic systems
- Enhancement of communicative interaction of robotic systems to other systems (including other robotic systems)
- Development of networked robotic architectures
- Creation of open source software architectures
- Development of improved cognitive and self-configuring software architectures
- Improvement of the (dynamic) models of physical, social and ecological environments validate sensor and motion performance
- Enhancement of user interfaces to improved human-machine interaction (two sided)
- Improvement of (real-time) dynamic models for robotic structures
- Improvement of the robustness of robotic architectures by redundancy in hardware, software and design
- Improvement of robotic safety through software (prediction and reaction), as well as physical systems
- Further miniaturisation and integration of actuators, sensors, control systems, energy systems and other physical manipulators
- Improved efficiency of energy systems, including power management and enhanced efficiency of locomotion
- Further development of low weight power sources
- Creation of efficient wireless power transmission systems
- Enhanced robot control systems, including self-learning, self-calibrating, fault tolerant, etc.
- Improved image recognition sensor systems, including environment assessment (objects, human emotions/behaviour, environments, etc.)
- Improved task, grasp, motion and distributed planning for robotic systems (interactive and intelligent planning, programming and scheduling)
- Improved integrated sensory systems, including multi-sensors and high quality (bio, neuro, physical, environmental, chemical, motion, positioning, etc.)
- New light-weight, high strength materials
- Advanced integrated mechatronic systems
- Advanced locomotion, including movement and grasping
- New concepts for distributed intelligence (e.g. swarms)
- Low cost robotic systems (sensors, control, locomotion, skelet, etc.)
- Enhancing the cognitive human reaction of robots
- Improved navigation through enhanced mapping and localisation (e.g. 3D, cooperative mapping, enhanced GPS, autonomous)

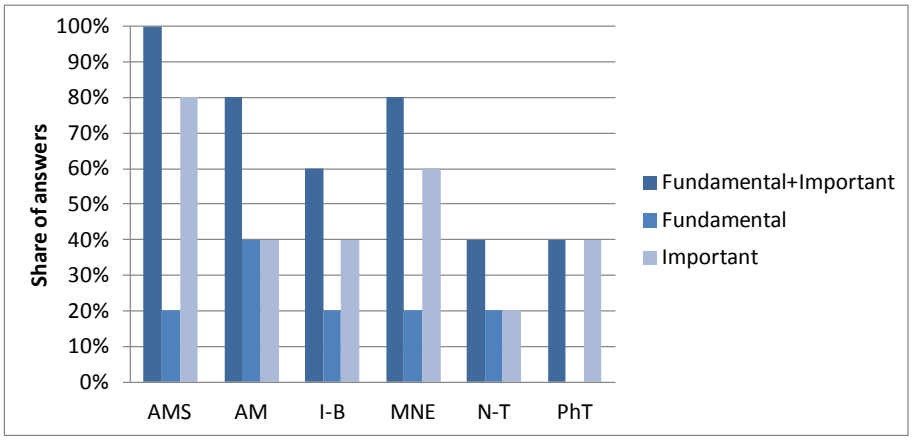
Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of improved robotic systems capable of supporting healthcare workers in patients' monitoring and care activities, building on pervasive sensing systems, enhancement of robotic communication, user interfaces, miniaturization and

integration of actuators, sensors, control systems, energy systems, etc., power management, enhanced efficiency of locomotion, and new light-weight, high strength materials.

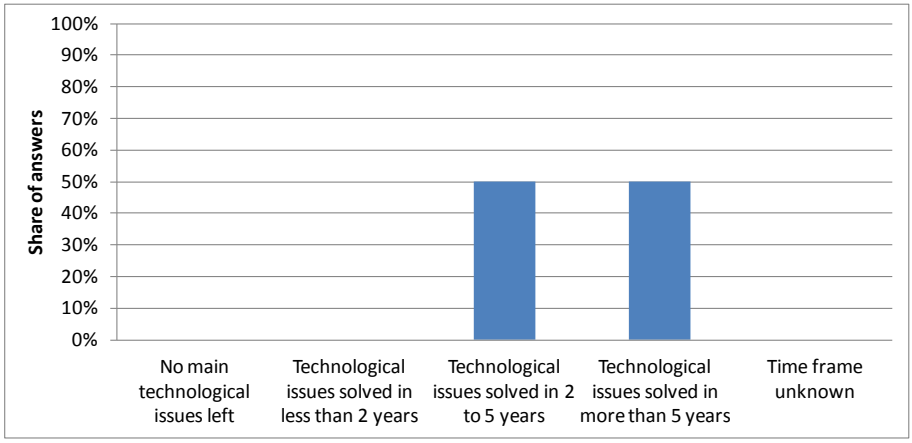
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong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



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 either 2 to 5 years or 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 short to medium term should be taken into consideration within this framework.

Additional information according to results of assessment:

➢ ***Impact assessment:***

- Robotics for healthcare is an emerging field which is expected to grow in the face of demographic change (ageing), expected shortages of healthcare personnel, calls for improving quality of life for the elderly and disabled, and the need for even higher quality care. All these factors stimulate innovation in the domain of robotics for healthcare. Several programs and networks dedicated to research on robotics

are already focusing part of their efforts on applications in healthcare (Source: EC-robotics for healthcare, Final Report, 2008).

- Actually, in the health and healthcare domain, robots have been applied since quite some time especially in aided surgery, where the Da Vinci surgical assistant is playing a significant role, having conducted more than 20 000 surgeries and having paved the way for robotic advancements in healthcare.
- Yet the market of robots performing or supporting surgery is highly dominated by the US.
- Within this framework, according to interviews and opinions collected at the workshops organized within the framework of the study, and as evidenced throughout desk research, one of the segments expected to grow in Europe is instead represented by robots supporting professional care to patients in the healthcare domain. This products category today already includes automated robotic delivery system that transport scheduled and on-demand deliveries of meals or medications in hospitals, at home and between ancillary, support, and patient care units.
- Demographic changes such as population ageing are the main driving force behind assistive technologies. Although many prerequisites in regard to these technologies, such as safe operation near humans, human-robot interaction, building intelligent robots, robots that learn while operating have not yet been fully met, automated and robotized systems are being increasingly introduced in healthcare. Robotic assistive technologies are a new market segment that will offer many business opportunities and jobs. When they are used to assist older persons, they will also redefine the care sector and upgrade the image of care work. In the long run, assistive technologies will ease the financial burden on the care system and facilitate the work of caregivers. Enabling older people to lead an independent life at home is one of the most important positive aspects. However, it should also be mentioned that many technological hurdles still have to be overcome before robots will become a standard device in older people's homes (Source: P. Flandorfer, Drivers, Barriers and long-term Requirements of assistive Technologies supporting older Persons in living longer independently at Home: A systematic Review of European, US-American and Japanese Policy Papers and Assessment Studies, 2012).

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

- 2 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Hence, no significant patent-related indicators can be reported in this field