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.3.2: Robotized systems capable to assist patients' mobility or other living functions

Scope:

To develop passive robotized systems (including intelligent prostheses) capable to assist patients' mobility or other living functions (e.g. exoskeletons for disabled patients).

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:

- Assistance to living functions
- Improved quality of life

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

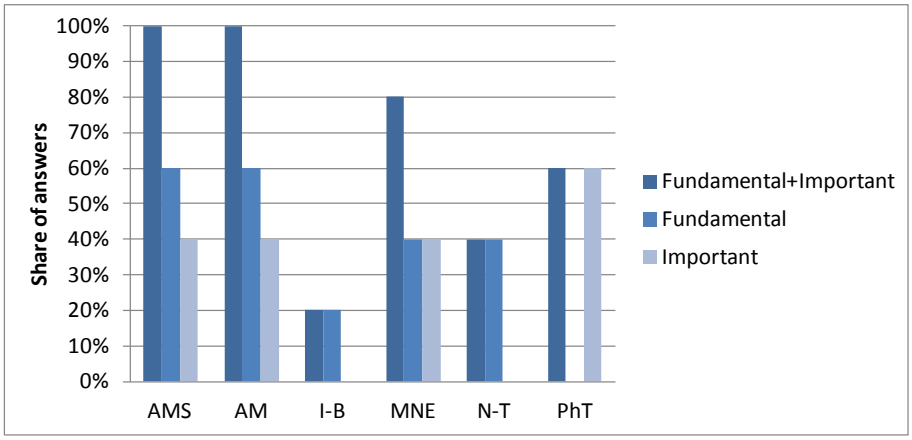
- Creation of robotic platform technologies to enhance standardization and cooperation
- Creation of open design and simulation systems to jointly develop new robotic systems
- Enhancement of communicative interaction of robotic systems to other systems (including other robotic systems)
- Development 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 advanced passive robotized systems including intelligent prostheses, building on the development and integration of new light-weight, high-strength materials, advanced integrated mechatronics, communicative interaction, user interfaces, miniaturization and integration of actuators, sensors, control and energy systems.

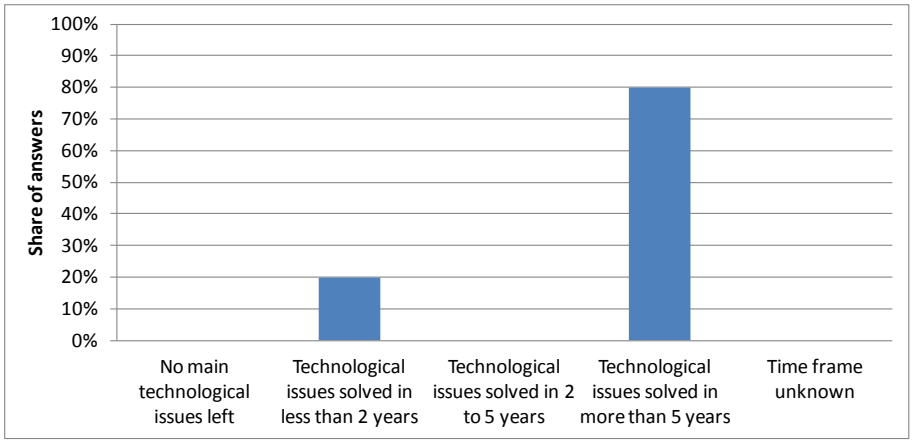
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong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

- 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 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:***
  - Increasing the autonomy of people with disabilities (including of people having experienced stroke or amputations) through robot-assisted mobility and advanced prostheses has the potential of facilitating these people's mobility besides their social development as a consequence, as well as reducing the burden of caring for such populations in both inpatient and outpatient settings. While techniques for task-specific assistance exist, they are largely focused on satisfying short-term goals (e.g. rehabilitation treatment and locomotion training) (Source: Y. Demiris and T. Carlson, Lifelong robot-assisted mobility: Models, Tools, and Challenges, In Proc. of IET Assisted Living Conference, London, March 2009).
  - For lifelong disabled users, however, fewer opportunities exist, despite the market of robot-assistive mobility is gaining much attraction as robotic and bionic systems evolve.
  - As a result of the evolving technologies and the consequent reductions in costs, these devices are even being moved considerably closer to everyday use. Examples thereof are constituted by the exoskeletons that Honda has begun leasing as Walking Assist Devices to hospitals in Japan so that the company can monitor and validate their usefulness in the real world. Other robot-assistive mobility devices, which are all at or close to market, are Panasonic's Activelink Powerloader, Cyberdyne's HAL, Argo Medical Technologies' Rewalk, Rex Bionics' REX, Ekso Bionics EKSO, Raytheon's XOS2, RB3D's Hercule and Lockheed Martin's HULC exoskeletons (Sources: www.corporate.honda.com; www.innovationtoronto.com).
  - Exoskeletons have been developed by the defence industries for applications in soldier and ground fields. Such knowledge and development capability can be transferred into the civilian sector for other medical applications that could significantly benefit from this previous development.
- ***Results of patents scenario analysis:***
  - 4 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