

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/rocket>

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.4.3: High bandwidth optical networks

Scope:

To develop advanced network infrastructures with ultrahigh bandwidth, mainly based on an optical backbone and taking advantage of solutions as radio over fibre or other seamless network technologies.

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

- Inclusive society is also about closing the digital divide (according to the Digital Agenda for Europe (DAE), 78% of EU citizens use the internet at least once a week, 20% never used the internet, and 62% of the EU has 30Mbps broadband, but only 18% of rural areas). Skills or network deployment are to be supported, but technological developments are required in broadband wireless communications, very high broadband wireline communications, networks interfacing and systems autonomous connectivity, user-friendliness
- With ubiquitous digitalization, cyber-security and protection of the communications is a crucial contributor to a safe EU secure and free society
- Improved transport and energy services, as well as all sorts of system monitoring services (environment monitoring, homeland surveillance, industrial supply chains, etc.) all rely on ever-growing flows of digital information, increasing the need for reliable high throughput communication networks
- Information and communication technologies consume around 2% of global energy consumption, and this is the sector with the fastest growth over past and probably upcoming years. Increasing energy efficiency in Information and Communication Technology (ICT) is crucial

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

- Volumes of data exchanges have been continuing growth in the recent years, while European telecommunication operators have been experiencing a drop. These operators expect improved communication networks to provide them with capabilities for new services and constitute important growth and profitability relays
- Normalization is a very important driver or barrier for telecom-related industrial activities. Being at the top-front of innovation in low layer telecoms often provides a direct competitive advantage
- Concern is growing in society about electromagnetic waves. In the meanwhile, the radiofrequency spectrum is a limited resource more and more intensively exploited. Optimizing wireless networks for minimizing resource use and possible health impacts is getting more and more important

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

- Development of optical network switching for hybrid traffic
- Implementation of radio-over-fibre access points, for wireless networks to rely on high bandwidth optic fibre networks while minimizing the need for heavy data processing and allowing more virtualization in the network
- Development of new seamless network technologies for ultra-high bandwidth
- Setup of large core diameter plastic fibre to ease large deployment of optic fibre (mainly for home usage)
- Development of optical routing back panels and very high rate signal processing capabilities for bottleneck avoidance in optical networks
- Replacement of traditional bus backbones by full-fibre backbones

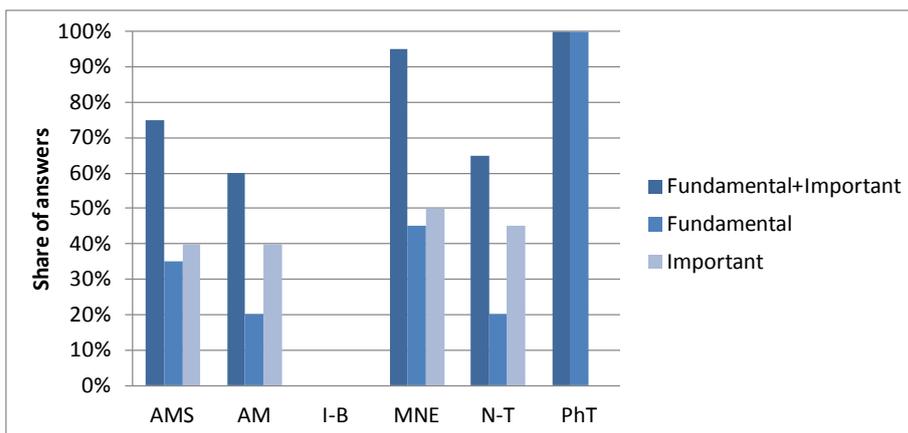
Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of advanced network infrastructures with ultra-high bandwidth, mainly based on an optical backbone and radio-over-fibre or other seamless network technologies, high bandwidth optical network switching for hybrid traffic, radio-over-fibre access points, optical routing back panels, replacement of traditional bus backbones by full-fibre backbones, etc.

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

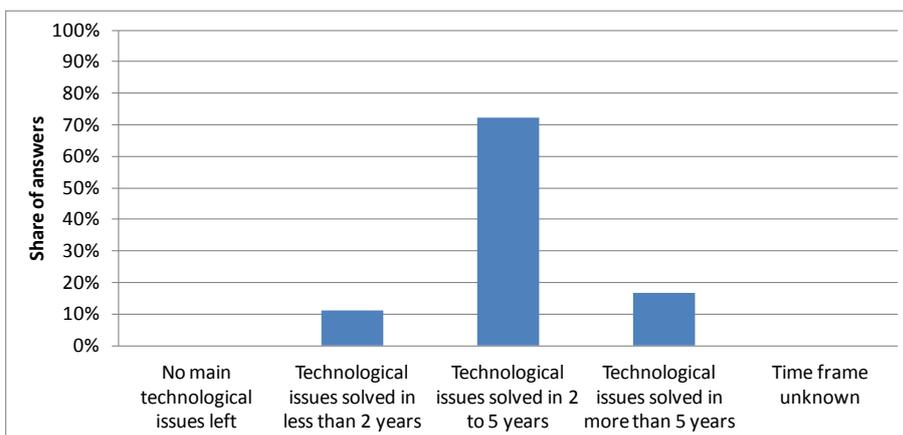
respect to this Innovation Field, with either fundamental or important contribution mainly by the following KETs:

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



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:

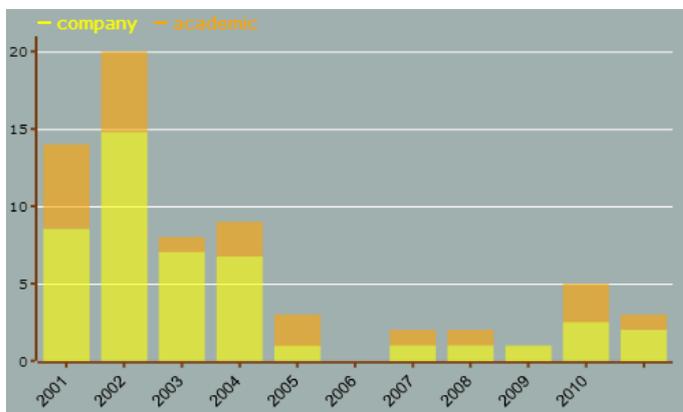
- A large share of front end communications are endorsed by wireless networks, but long distance and high volume data communications have to – and will continue – rely on wire/fibre-based networks. As the data rates are increasing, these networks face increasing bandwidth demand and wire/fibre availability is diminishing. To support Pillar IV of the Digital Agenda for Europe – Fast and ultra-fast Internet access, objective of 30 Mbps download capability all over Europe and 50% of European households subscribed at >100 Mbps services – and thus go on with increasing data volumes and enabling the development of bandwidth intensive applications – like HD video streaming, cloud

computing, machine to machine communications, data mining , e-Health, etc. – network operators have to move towards more and full optical networks, able to provide high performance and quality of service at reduced costs.

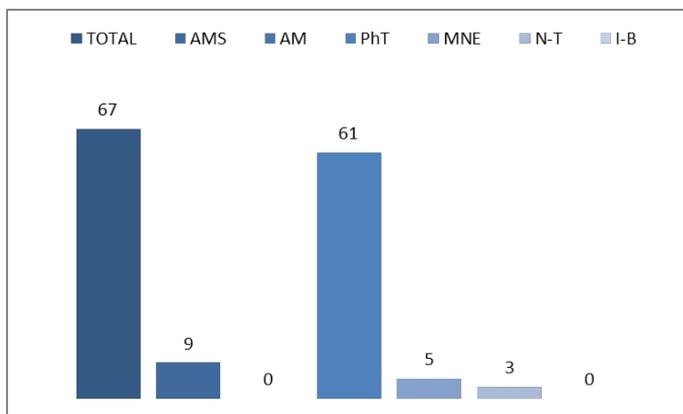
- Optical networks are already being deployed in dense urban or “bit-intensive” areas, down to final users in the cases of “Fibre-to-the-home” (FFTH) or “Fibre-to-the-building” deployments, but further KET-enabled systems deployment is necessary for large-scale systematic implementation and bottleneck avoidance which will bring additional benefits. As stated in the EU Digital Agenda, “a 10% increase in broadband penetration brings up the GDP by 1-1.5%”.

➤ **Results of patents scenario analysis:**

- 67 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Since early 2000 years, annual applications in the field remain at a relatively low level, with a significant share of academic applicants:



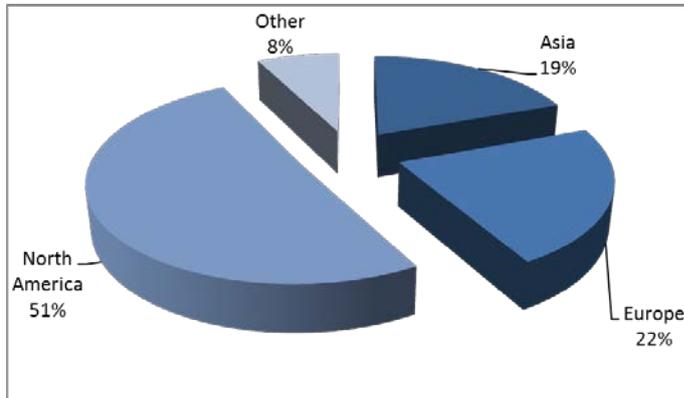
- Patents by KET(s):



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

KET(s)	Number of patents
AMS	9
AMS / PhT	3
MNE	5
MNE / N-T	2
MNE / N-T / PhT	2
MNE / PhT	5
N-T	3
N-T / PhT	3
PhT	61

- Patent distribution by (Applicant) organization geographical zone:
- Patent application is not particularly concentrated, with the biggest applicant (Samsung) having applied only 3 patent families in the period



- Patent distribution by geographical zone of priority protection:

