OECD Science, Technology and Innovation Outlook 2016

10 key technology trends for the future

What technologies are expected to disrupt economies and societies over the next 10-15 years? How can emerging technologies contribute new or improved solutions to the multiple challenges facing the world, for example, around ageing, climate change, and natural resource depletion? And what roles can public policy play in shaping the pace and direction of technological change so that it addresses these sorts of challenges without causing undue harm to human well-being and the environment?

These are among the main questions raised in the OECD Science, Technology and Innovation Outlook 2016. Drawing on the findings of several recently-completed foresight exercises, the STI Outlook identifies 40 key and emerging technologies for the future. It then discusses 10 of those technologies that are among the most promising and potentially most disruptive and that, in some instances, carry significant risks. The STI Outlook describes each technology in turn, covering potential areas of application, the conditions for future development, and possible future barriers, including technological, social, regulatory and ethical issues.

Figure 1. 40 key and emerging technologies for the future

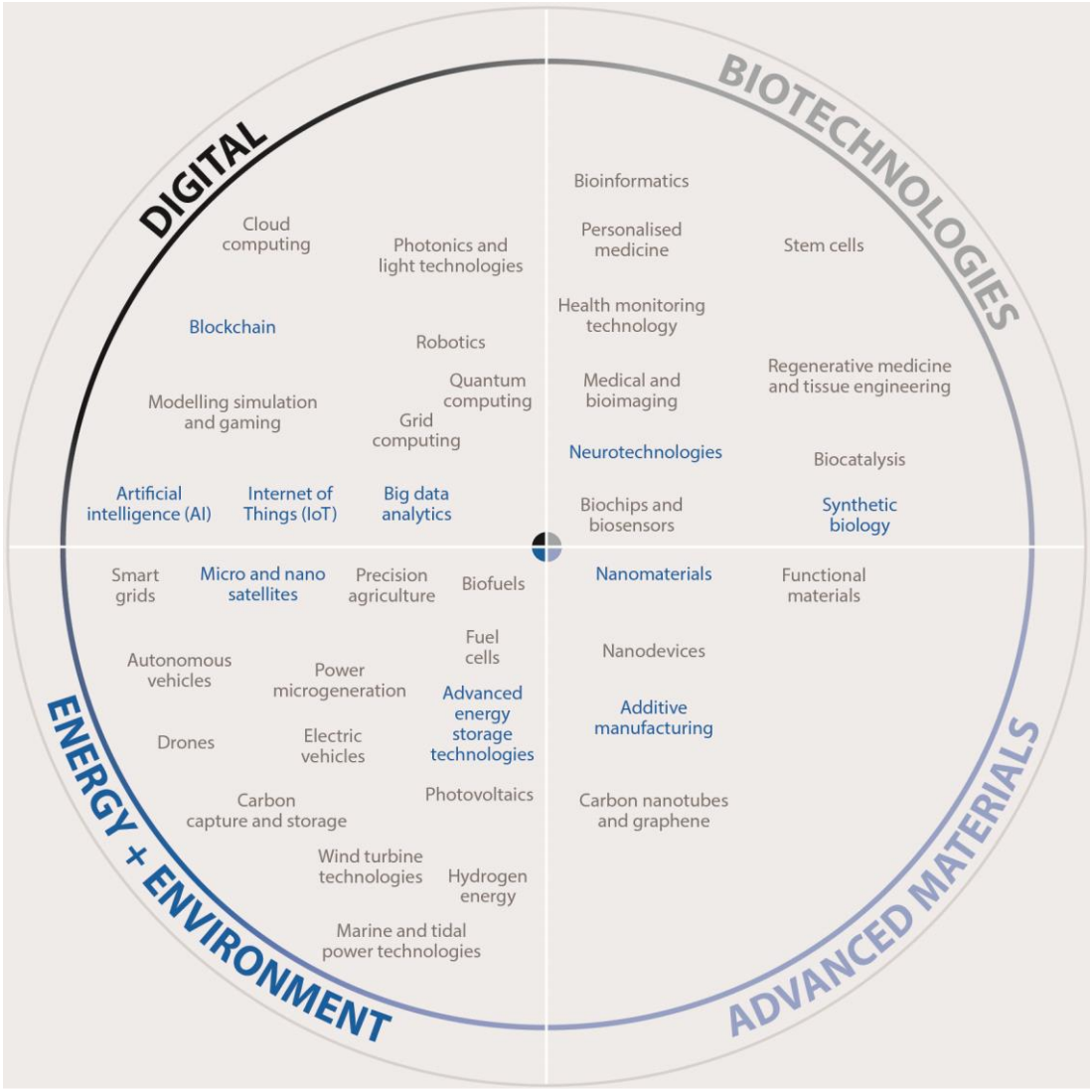

Table 2. 10 key and emerging technologies featured in the STI Outlook 2016

 Additive Manufacturing	Progressively adding material to make a product take shape is an unprecedented approach to manufacturing that warrants new business models and implies significant changes to existing industries. However, this technology must overcome several challenges, both technical and regulatory, if it is to permeate industrial processes on a large scale.	 Internet of Things	The Internet of Things promises a hyper-connected, digitally responsive society that will have a profound impact on all sectors of the economy and society. While it has great potential to support human, societal and environmental development, several safeguards need to be put in place to ensure data protection and security.
 Advanced Energy Storage Technologies	Energy storage technology can be defined as a system that absorbs energy and stores it for a period of time before releasing it on demand to supply energy or power services. Breakthroughs are needed in this technology to optimise the performance of energy systems and facilitate the integration of renewable energy resources.	 Micro and Nano Satellites	Increasing use is being made of small and very small satellites with growing capabilities. This will give policy makers an expanding spectrum of sophisticated tools to address "grand" challenges for both civilian and defence purposes.
Artificial Intelligence	Artificial intelligence seeks to endow machines with reasoning capabilities that may one day surpass those of human beings. While their full impact remains difficult to appraise, intelligent systems are likely to bring considerable productivity gains and lead to irreversible changes in our societies.	 Nanomaterials	Nanomaterials display unique optical, magnetic and electrical properties that can be exploited in various fields, from healthcare to energy technologies. However, technical constraints and uncertainties over their toxicity to humans and the environment continue to hinder their widespread application.
 Big Data Analytics	Analytics tools and techniques are needed to reap the promises of big data. The socio-economic implications are tremendous, but a major policy challenge will be to balance the need for openness with the threats that an extreme "datafication" of social life could raise for privacy, security, equity and integrity.	 Neurotechnologies	Emerging neurotechnologies offer great promise in diagnosis and therapy for healthy ageing and general human enhancement. However, some neurotechnologies raise profound ethical, legal, social and cultural issues that require policy attention.
 Blockchain	Blockchain is a database that allows the transfer of value within computer networks. This technology is expected to disrupt several markets by ensuring trustworthy transactions without the necessity of a third party. The proliferation of this technology is, however, threatened by technical issues that remain to be resolved.	 Synthetic Biology	Synthetic biology draws on engineering principles to manipulate DNA in organisms. It allows for the design and construction of new biological parts and the re-design of natural biological systems for useful purposes. It is expected to have a wide range of applications in health, agriculture, industry and energy, but it also raises major legal and ethical issues.

These technologies are diverse in the ways they have impact and in the pace of their development and adoption. Many rely on convergence with other technologies for their future development and exploitation. Yet, despite their variety, these technologies exhibit some common features. Each is underpinned by public sector research, which plays a pivotal role in generating new knowledge and nurturing the skills needed for further developing and exploiting emerging technologies. Research and innovation efforts around emerging technologies are also increasingly distributed across the world and typically benefit from international cooperation. At the same time, competition is fierce, focusing not only on technical solutions, but also on complementary assets, such as business models, platforms and standards that can make the difference between success and failure.

Policy has important roles to play beyond public research. Emerging technologies carry several risks and uncertainties, and many raise important ethical issues, too, which need to be mediated by government. The creative destruction of technological change also creates winners and losers. Policy needs to address the distribution effects of technological change, for example, through regulations that maintain market competition, by retraining workers with obsolete skills, and by promoting technology diffusion across the economy, particularly to small and medium-sized enterprises.