

The top 10 emerging technologies for 2012



Emerging technologies are critical to building a sustainable and resilient future. But without new understanding, tools and capabilities, their safe and successful development is far from guaranteed.

At the Summit on the Global Agenda 2011 in Abu Dhabi, United Arab Emirates, the World Economic Forum's Global Agenda Council on Emerging Technologies asked some of the world's leading minds within the entire GAC Network which technology trends would have the greatest impact on the state of the world in the near future.

Below, the Global Agenda Council on Emerging Technologies presents the technological trends expected to have major social, economic and environmental impacts worldwide in 2012. They are listed in order of greatest potential to provide solutions to global challenges:

1. Informatics for adding value to information

The quantity of information now available to individuals and organizations is unprecedented in human history, and the rate of information generation continues to grow exponentially. Yet, the sheer volume of information is in danger of creating more noise than value, and as a result limiting its effective use. Innovations in how information is organized, mined and processed hold the key to filtering out the noise and using the growing wealth of global information to address emerging challenges.

2. Synthetic biology and metabolic engineering

The natural world is a testament to the vast potential inherent in the genetic code at the core of all living organisms. Rapid advances in synthetic biology and metabolic engineering are allowing biologists and engineers to tap into this potential in unprecedented ways, enabling the development of new biological processes and organisms that are designed to serve specific purposes – whether converting biomass to chemicals, fuels and materials, producing new therapeutic drugs or protecting the body against harm.

3. Green Revolution 2.0 – technologies for increased food and biomass

Artificial fertilizers are one of the main achievements of modern chemistry, enabling unprecedented increases in crop production yield. Yet, the growing global demand for healthy and nutritious food is threatening to outstrip energy, water and land resources. By integrating advances across the biological and physical sciences, the new green revolution holds the promise of further increasing crop production yields, minimizing environmental impact, reducing energy and water dependence, and decreasing the carbon footprint.

4. Nanoscale design of materials

The increasing demand on natural resources requires unprecedented gains in efficiency. Nanostructured materials with tailored properties, designed and engineered at the molecular scale, are already showing novel and unique features that will usher in the next clean energy revolution, reduce our dependence on depleting natural resources, and increase atom-efficiency manufacturing and processing.

5. Systems biology and computational modelling/simulation of chemical and biological systems
For improved healthcare and bio-based manufacturing, it is essential to understand how biology and chemistry work together. Systems biology and computational modelling and simulation are playing increasingly important roles in designing therapeutics, materials and processes that are highly efficient in achieving their design goals, while minimally impacting on human health and the environment.

6. Utilization of carbon dioxide as a resource

Carbon is at the heart of all life on earth. Yet, managing carbon dioxide releases is one of the greatest social, political and economic challenges of our time. An emerging innovative approach to carbon dioxide management involves transforming it from a liability to a resource. Novel catalysts, based on nanostructured materials, can potentially transform carbon dioxide to high value hydrocarbons and other carbon-containing molecules, which could be used as new building blocks for the chemical industry as cleaner and more sustainable alternatives to petrochemicals.

7. Wireless power

Society is deeply reliant on electrically powered devices. Yet, a significant limitation in their continued development and utility is the need to be attached to the electricity grid by wire – either permanently or through frequent battery recharging. Emerging approaches to wireless power transmission will free electrical devices from having to be physically plugged in, and are poised to have as significant an impact on personal electronics as Wi-Fi had on Internet use.

8. High energy density power systems

Better batteries are essential if the next generation of clean energy technologies are to be realized. A number of emerging technologies are coming together to lay the foundation for advanced electrical energy storage and use, including the development of nanostructured electrodes, solid electrolysis and rapid-power delivery from novel supercapacitors based on carbon-based nanomaterials. These technologies will provide the energy density and power needed to supercharge the next generation of clean energy technologies.

9. Personalized medicine, nutrition and disease prevention

As the global population exceeds 7 billion people – all hoping for a long and healthy life – conventional approaches to ensuring good health are becoming less and less tenable, spurred on by growing demands, dwindling resources and increasing costs. Advances in areas such as genomics, proteomics and metabolomics are now opening up the possibility of tailoring medicine, nutrition and disease prevention to the individual. Together with emerging technologies like synthetic biology and nanotechnology, they are laying the foundation for a revolution in healthcare and well-being that will be less resource intensive and more targeted to individual needs.

10. Enhanced education technology

New approaches are needed to meet the challenge of educating a growing young population and providing the skills that are essential to the knowledge economy. This is especially the case in today's rapidly evolving and hyperconnected globalized society. Personalized IT-based approaches to education are emerging that allow learner-centred education, critical thinking development and creativity. Rapid developments in social media, open courseware and ubiquitous access to the Internet are facilitating outside classroom and continuous education.

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