TECHNOLOGY AND INNOVATION REPORT 2018

Harnessing Frontier Technologies for Sustainable Development

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FRONTIER TECHNOLOGIES CAN BE A POWERFUL FORCE TO DELIVER SUSTAINABLE DEVELOPMENT

Technological change has the potential to achieve SDGs faster, more sustainably and more efficiently.

Key frontier technologies: Big data, Internet of Things, AI, 3D Printing, Biotech, Nanotech, Renewable Energy, Drones, Satellites
FRONTIER TECHNOLOGIES: A BETTER FUTURE NOW

Uganda: Outbreak data visualization and interactive mapping

Bangladesh: Wireless sensors for water quality monitoring

South Africa: 3D printing for prosthetics

Kenya: Big data analytics for affordable agricultural insurance

And more...
What makes frontier technologies different:

- They build on each other
- Change is exponential
- Technologies converge and recombine
- Dramatic reductions in costs
- Leverage of digital platforms
- Democratizing innovation
# Potential Economic Impact of Internet of Things in 2025

<table>
<thead>
<tr>
<th>Application</th>
<th>Low Estimate</th>
<th>High Estimate</th>
<th>Major Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>170–1,590</td>
<td></td>
<td>Monitoring and managing illness, improving wellness</td>
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<tr>
<td>Home</td>
<td>200–350</td>
<td></td>
<td>Energy management, safety and security, chore automation, usage-based design of appliances</td>
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<tr>
<td>Retail environments</td>
<td>410–1,160</td>
<td></td>
<td>Automated checkout, layout optimization, smart CRM, in-store personalized promotions, inventory shrinkage prevention</td>
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<tr>
<td>Offices</td>
<td>70–150</td>
<td></td>
<td>Organizational redesign and worker monitoring, augmented reality for training, energy monitoring, building security</td>
</tr>
<tr>
<td>Factories</td>
<td>1,210–3,700</td>
<td>1,210–3,700</td>
<td>Operations optimization, predictive maintenance, inventory optimization, health and safety</td>
</tr>
<tr>
<td>Worksites</td>
<td>160–930</td>
<td></td>
<td>Operations optimization, equipment maintenance, health and safety, IoT-enabled R&amp;D</td>
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<tr>
<td>Vehicles</td>
<td>210–740</td>
<td></td>
<td>Condition-based maintenance, reduced insurance</td>
</tr>
<tr>
<td>Cities</td>
<td>930–1,660</td>
<td></td>
<td>Public safety and health, traffic control, resource management</td>
</tr>
<tr>
<td>Outside</td>
<td>560–850</td>
<td></td>
<td>Logistics routing, autonomous cars and trucks, navigation</td>
</tr>
</tbody>
</table>

Size in 2025:

- Total = $3.9 trillion–11.1 trillion

- Includes sized applications only.

- Note: Numbers may not sum due to rounding.
ECONOMIC AND SOCIETAL CHALLENGES

Frontier technologies have effects on:

▪ Employment, inequality
▪ Market power concentration
▪ Economic, social, technological divides among countries
▪ Privacy, algorithmic transparency, ethical questions
THE DIVIDE IN TECHNOLOGICAL CAPABILITIES

Researchers per million inhabitants

Large divides among countries in technical skills and R&D efforts and capacity. Developing countries, particularly LDCs lag behind in:

- R&D expenditures
- Number of Researchers
- STEM graduates
- Gender gaps in technical education, employment in the manufacturing and ICT sectors, and in access to ICTs and the Internet.
THE DIVIDE IN ICT IMPACTS INNOVATION CAPABILITY

- The connection between electricity access and Internet use (rural populations are excluded from both).

- ICT is a CRITICAL infrastructure: it clearly has an influential role in innovation.
FRONTIER TECHNOLOGIES CANNOT DELIVER WITHOUT THE BASICS OF STI POLICY

- CAPABILITIES
- CONNECTIONS
- ENABLING ENVIRONMENT
  - FINANCING
  - INFRASTRUCTURE
Sophisticated programming skills
Knowledge of complex algorithms

Computing skills
Familiarity with algorithms

Basic understanding of technologies, software and applications
Knowledge of digital rights, privacy, security and permanence of data
Ability to collaborate, communicate and create using technologies

Basic education and literacy
Familiarity with technology devices and services

**Adoption**

**Basic use**

**Creative use and adaptation of technologies**

**Creation of new technologies**

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FRONTIER TECHNOLOGIES AND INCLUSIVENESS

Rethinking the social compact:

- Lifelong learning,
- Universal Basic Income (UBI)
LEAPFROGGING: LOOK BEFORE YOR LEAP?

- Leapfrogging has delivered benefits in key technologies (starting with mobile telephony, but also mobile money, off-grid renewable energy, ICTs for education-MOOC)
- Potential second-degree applications in agriculture, health care, industry, transport, sharing economy
- Leapfrogging as a user vs. producer of tech and the need for local technological capabilities

FRONTIER TECHNOLOGIES PROMOTE NEW APPROACHES TO INNOVATION

- Digital technologies greatly assist: scaling-up of low-cost products and services; innovations by the poor; and social innovation
- Smart specialization
- Platforms for economic discovery
- Incubators, accelerators and technology parks
SHAPING RESEARCH COLLABORATION TO ADDRESS THE SDGS

Science is becoming an ever more international enterprise.

Co-authorships are increasing, and internationally co-authored articles are cited more often.

Source: Elsevier, with thanks to Jeroen Baas.
CHANGES IN THE FUNDING OF INNOVATION

Innovative financing:
- Innovation and technology funds,
- New types of bonds,
- Crowdfunding,
- Venture capital, business angels, impact investment
A CONCERTED EFFORT IS NEEDED…

Focus on building capabilities and supporting all forms of innovation.

UNCTAD and UN CSTD a forum for international policy dialogue about development implications of frontier technologies.