MEASURING THE DIGITAL ECONOMY
OECD EXPERIENCE

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Countries see the Digital Economy as a driver of competitiveness, growth and well-being

- 27 out of 34 countries have a national digital strategy
- Whole-of-the-government and cross sector

The Digital Economy goes beyond ICT industries
- Demand-side objectives feature prominently
- Governments are working in several policy areas

Digital Economy is a priority for governments
Ministerial Meeting on the Digital Economy
22-23 June 2016 - Mexico

• 1998 Ottawa: Uptake
• 2008 Seoul: Diffusion
• 2016 Cancun: Impact

4 issues:
• Internet Governance
• Security & Privacy
• Connectivity
• ICTs, Jobs & Skills
Committee for Digital Economy Policies (CDEP)

- Working Party on Communication Infrastructures and Services Policy (CISP)
- Working Party on Security and Privacy in the Digital Economy (SPDE)
MADE – what we do

• Agree on international statistical standards:
  ICT industries & products; e-commerce, ICT patents...

• Model surveys on ICT usage by business/ individuals

• New measurement tools:
  Internet-based statistics

• Economic analysis based on the above
The growing importance of the digital economy today

THE MOBILE BROADBAND REVOLUTION
3 out of 4 OECD inhabitants now have mobile wireless broadband...

Mobile wireless broadband penetration, by technology, December 2009 and 2013
Subscriptions per 100 inhabitants

http://dx.doi.org/10.1787/888933147973
...and a majority buy powerful devices...

The progress of smartphones, 2010-13
Quarterly global shipping trends

...with intensity of use a function of available applications...

Smartphone apps availability and usage, 2013

Average number per user

http://dx.doi.org/10.1787/888933148094
...and with many people now owning multiple devices...

**Devices used to access the Internet, 2013**

Variety of devices per user linked to the percentage of Internet users


[http://dx.doi.org/10.1787/888933148083](http://dx.doi.org/10.1787/888933148083)
...and usage and devices are correlated with the price of access.

Prices of mobile voice calls plus data traffic reference baskets, Feb. 2014
USD PPP per month

http://dx.doi.org/10.1787/8883148078
Broadband speed has been increasing...

Trends in broadband speed across the OECD, Q4 2009-13
Average download speed in Mbit/s, all technologies combined

...although large differences across countries exist.

Fixed (wired) broadband penetration rates by speed tiers, December 2013
As a percentage of subscriptions

http://dx.doi.org/10.1787/888933148053
USAGE PATTERNS FOR INDIVIDUALS
With more BB, more use occurs…

Internet usage trends in the OECD
By country change between 2006 and 2013

http://dx.doi.org/10.1787/888933147770
...but large differences exist between countries...

Internet usage trends in the OECD
Percentage of 16-74 year-olds using the Internet, by country change between 2006 and 2013

http://dx.doi.org/10.1787/888933147770
For Internet usage, age matters...

Internet usage trends in the OECD and differences by age groups
Age gap: 16-24 vs. 65-74 year-olds

http://dx.doi.org/10.1787/888933147770
Internet users among 55-74 year-olds by educational attainment level, 2013

As a percentage of 55-74 year-olds in each educational attainment group

... and when it comes to money...

Participation in e-commerce by individuals, 2007-08 and 2012-13

http://dx.doi.org/10.1787/888933147963
...but less so for some countries.

Individuals who purchased online in the last 12 months, by age class, 2013
As a percentage of Internet users

http://dx.doi.org/10.1787/888933148373
The diffusion of selected online activities among Internet users, 2012-13

Percentage of Internet users performing each activity

…while some purchases have migrated on-line more than others.

Online purchasers by selected type of products, 2013
As a percentage of Internet users having purchased online

USAGE PATTERNS FOR BUSINESSES
Differences exist in use by business...

The diffusion of selected ICT tools and activities in enterprises, 2013
Percentage of Internet users performing each activity

http://dx.doi.org/10.1787/888933148510
Enterprises engaged in sales via e-commerce, by employment size, 2008 and 2012
As a percentage of enterprises in each employment size class

http://dx.doi.org/10.1787/888933148789
...as well as by country.

Turnover from e-commerce, by size, 2008 and 2012
As a percentage of turnover in each employment size class

ICT CHALLENGES GOING FORWARD
Challenges exist for security…

Businesses having encountered IT security problems, attacks resulting in denial-of-service, by size, 2010

As a percentage of all businesses in each employment size class

http://dx.doi.org/10.1787/888933148142
Main reasons for not buying online because of privacy and security concerns, 2009 or more recent year available
Percentage of Internet users who did not make online purchases

http://dx.doi.org/10.1787/888933148160
...ICT skill acquisition...

Individuals who judge their computer skills to be sufficient if they were to apply for a new job within a year, 2013

As a percentage of all individuals

...bringing government services on-line...

**Individuals using e-government services, 2010 and 2013**

Percentage of individuals obtaining information and sending completed forms on government websites in the last 12 months

[http://dx.doi.org/10.1787/888933148419](http://dx.doi.org/10.1787/888933148419)
Dismantling the borders to selling via electronic commerce ...

Cross-border e-commerce sales by enterprises, 2012
As a percentage of all enterprises having undertaken sales via e-commerce

http://dx.doi.org/10.1787/888933148101
Cross-border online purchases by individuals, 2013
As a percentage of individuals who ordered goods or services over the Internet in the past 12 months

http://dx.doi.org/10.1787/888933148115
Emerging economies are becoming ICT innovators...

Specialisation in ICT-related patents, 1999-2001 and 2009-11
ICT-related patents as a percentage of total PCT patent applications, by country

...and the gap is narrowing.

Top 15 applicants’ share in ICT-related patent applications, 1999-2001 and 2009-11

Percentage of total PCT patent applications in ICT-related technologies

OPPORTUNITIES TO SEIZE
The ICT sector was dynamic during the crisis …

**Net business population growth between 2009 and 2012**

Average annual growth rate

The cost of data storage has been declining…

Average data storage cost for consumers, 1998-2012
Per Gbit

http://dx.doi.org/10.1787/888933147819
...and emerging data-mining techniques are leading to innovations that increase well-being

Cost of genome sequencing, 2001-14
Cost per genome, logarithmic scale

The economic effects of ICTs

- ICT investment & growth
- ICT producing sector & productivity
- ICT-enabled innovation
- ICT & student performances (PISA)

- ICT & jobs
- ICT & skills
Where will new jobs be created?

Annual contribution of the ICT sector to total employment growth in the OECD area, 2001-2013

ICT and total employment growth (left-hand scale), percentage contribution to total employment (right hand scale)

Where will new jobs be created?

Employment in the ICT sector and sub-sectors, 2013

Where will new jobs be created?

ICT specialists in OECD economies, 2014

As a share of total employment, by category

Where will new jobs be created?

OECD employment growth by industry 2000-2012

Source: OECD National Accounts 2015
Do ICT investments substitute for jobs?

Fast technological progress in ICTs

↓

rapid decrease in ICT equipment/software price

↓

large investments in ICTs
Opposite effects

2 effects on labour demand:

1. **Substitution**: change in production mix
   *labour, ICT capital & non-ICT capital*

2. **Output**: increase in final demand
   *lower unit costs, lower prices and/or higher income*
Change in employment following a permanent 5%-decrease in the user cost of ICT capital

Change in the user cost of ICT capital, 1990-2012
Average yearly rate (%)
Employment growth due to decrease in ICT user costs

Average yearly rates (%)

“ON DEMAND” EMPLOYMENT
Sharing Economy: a variety of models

SUPPLY

*Peer*

**Selling (producing) products**

MATCHING

*e-bay, Etsy*

**Buying products**

**Airbnb, Uber, Lending Club, TaskRabbit**

**Renting capacity, e.g. assets, money, skills**

DEMAND

*Peer*

**Buying services, e.g. mobility, credit**

**Pooling capacity, e.g. money, ideas**

*Crowd*

**Kickstarter, AngeList, Quirky**

**Sourcing capacity, e.g. money, ideas**

*Producer*
Fast growing firms

Lending Club

- 8 years // USD 5.4 billion

Airbnb

- 7 years // USD 20 billion

Uber

- 6 years // USD 40 billion
Opportunities and challenges

<table>
<thead>
<tr>
<th>Markets</th>
<th>Employment</th>
<th>Consumers</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Innovation</td>
<td>- Re-organisation of work</td>
<td>- Diversification</td>
<td>- Distributed</td>
</tr>
<tr>
<td>- Efficiency</td>
<td>- Flexibility</td>
<td>- More informed choices</td>
<td>- Collaborative</td>
</tr>
<tr>
<td>- Competition</td>
<td></td>
<td></td>
<td>- Open</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Disruption</td>
<td>- Cobbled-together income</td>
<td>- Trust</td>
<td>IP rights</td>
</tr>
<tr>
<td>- Incumbents</td>
<td>- Insecurity, risks</td>
<td>- Protection</td>
<td>Incentives</td>
</tr>
</tbody>
</table>

... some of which are both an opportunity and a challenge
Policy issues

Key question: How can governments foster innovation, while ensuring worker and consumer protection in the “sharing economy”?

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<td>• Status</td>
<td>• Liability</td>
<td>• IP rights</td>
</tr>
<tr>
<td>• Regulation</td>
<td>• Insurance</td>
<td>• Protection</td>
<td>• Regulation</td>
</tr>
<tr>
<td>• Legislation</td>
<td>• Pensions</td>
<td>• Enforcement</td>
<td>• Funding</td>
</tr>
</tbody>
</table>
ICT & SKILLS
ICTs at work raise demand for new skills

1. **ICT generic skills**
   ability to use ICTs in daily work, e.g.: use software, send email, etc.

2. **ICT specialist skills**
   ability to program software, develop applications, manage networks, etc.

3. **ICT complementary skills**
   ability to carry out work in a technology-rich environment, e.g.: communicate on social networks, brand products on e-commerce platforms, etc.
ICT generic skills at work

Two steps:

1. Intensity of ICT use in each occupation (PIAAC)

2. Demand for ICT generic skills

   ICT intensity linked to employment by occupation (LFS)
Top-20 *ICT-intensive occupation* across countries

15 out of the top-20 ICT-intensive occupations are not ICT specialist occupations

<table>
<thead>
<tr>
<th>Rank</th>
<th>Occupation</th>
<th>ISCO-08</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Administration professionals</td>
<td>242</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>Information and communications technology service managers</td>
<td>133</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td><em>Business services and administration managers</em></td>
<td>121</td>
<td>95%</td>
</tr>
<tr>
<td>4</td>
<td>Finance professionals</td>
<td>241</td>
<td>95%</td>
</tr>
<tr>
<td>5</td>
<td>Information and communications technology operations and user support</td>
<td>351</td>
<td>95%</td>
</tr>
<tr>
<td>6</td>
<td>Sales, marketing and development managers</td>
<td>122</td>
<td>95%</td>
</tr>
<tr>
<td>7</td>
<td>Sales, marketing and public relations professionals</td>
<td>243</td>
<td>89%</td>
</tr>
<tr>
<td>8</td>
<td>Software and applications developers and analysts</td>
<td>251</td>
<td>89%</td>
</tr>
<tr>
<td>9</td>
<td>Database and network professionals</td>
<td>252</td>
<td>84%</td>
</tr>
<tr>
<td>10</td>
<td>Financial and mathematical associate professionals</td>
<td>331</td>
<td>79%</td>
</tr>
<tr>
<td>11</td>
<td>Electrotechnology engineers</td>
<td>215</td>
<td>74%</td>
</tr>
<tr>
<td>12</td>
<td>Engineering professionals (excluding electrotechnology)</td>
<td>214</td>
<td>68%</td>
</tr>
<tr>
<td>13</td>
<td>Managing directors and chief executives</td>
<td>112</td>
<td>68%</td>
</tr>
<tr>
<td>14</td>
<td>Physical and earth science professionals</td>
<td>211</td>
<td>68%</td>
</tr>
<tr>
<td>15</td>
<td>Professional services managers</td>
<td>134</td>
<td>63%</td>
</tr>
<tr>
<td>16</td>
<td>Authors, journalists and linguists</td>
<td>264</td>
<td>58%</td>
</tr>
<tr>
<td>17</td>
<td>Legislators and senior officials</td>
<td>111</td>
<td>53%</td>
</tr>
<tr>
<td>18</td>
<td>Life science professionals</td>
<td>213</td>
<td>53%</td>
</tr>
<tr>
<td>19</td>
<td>Sales and purchasing agents and brokers</td>
<td>332</td>
<td>42%</td>
</tr>
<tr>
<td>20</td>
<td>Business services agents</td>
<td>333</td>
<td>37%</td>
</tr>
</tbody>
</table>
Demand for **ICT generic skills** by country

Economy-wide index of ICT intensity at work

Source: OECD 2015, based on PIAAC
### Top-20 ICT specialist-intensive occupations

13 out of the top-20 occupations are not commonly classified as ICT occupations

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<td>7</td>
<td>Electrotechnology engineers</td>
<td>215</td>
<td>79%</td>
</tr>
<tr>
<td>8</td>
<td>University and higher education teachers</td>
<td>231</td>
<td>74%</td>
</tr>
<tr>
<td>9</td>
<td>Mathematicians, actuaries and statisticians</td>
<td>212</td>
<td>63%</td>
</tr>
<tr>
<td>10</td>
<td>Architects, planners, surveyors and designers</td>
<td>216</td>
<td>63%</td>
</tr>
<tr>
<td>11</td>
<td>Vocational education teachers</td>
<td>232</td>
<td>58%</td>
</tr>
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<td>12</td>
<td>Telecommunications and broadcasting technicians</td>
<td>352</td>
<td>58%</td>
</tr>
<tr>
<td>13</td>
<td>Physical and engineering science technicians</td>
<td>311</td>
<td>53%</td>
</tr>
<tr>
<td>14</td>
<td>Electronics and telecommunications installers and repairers</td>
<td>742</td>
<td>53%</td>
</tr>
<tr>
<td>15</td>
<td>Blacksmiths, toolmakers and related trades workers</td>
<td>722</td>
<td>42%</td>
</tr>
<tr>
<td>16</td>
<td>Life science professionals</td>
<td>213</td>
<td>37%</td>
</tr>
<tr>
<td>17</td>
<td>Metal processing and finishing plant operators</td>
<td>812</td>
<td>37%</td>
</tr>
<tr>
<td>18</td>
<td>Administration professionals</td>
<td>242</td>
<td>32%</td>
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<td>20</td>
<td>Process control technicians</td>
<td>313</td>
<td>32%</td>
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</table>

Source: OECD 2015, based on PIAAC
Demand for **ICT specialist skills** by country

Economy-wide index of ICT specialist intensity

Source: OECD 2015, based on PIAAC
Enterprises that reported hard-to-fill vacancies for ICT specialists

As a percentage of all enterprises
### Top-10 jobs that employers are having difficulty filling

**Talent Shortage Survey (Manpower, 2015)**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Job</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Skilled Trade Workers</td>
</tr>
<tr>
<td>2</td>
<td>Sales Representatives</td>
</tr>
<tr>
<td>3</td>
<td>Engineers</td>
</tr>
<tr>
<td>4</td>
<td>Technicians</td>
</tr>
<tr>
<td>5</td>
<td>Drivers</td>
</tr>
<tr>
<td>6</td>
<td>Management/Executives</td>
</tr>
<tr>
<td>7</td>
<td>Accounting &amp; Finance Staff</td>
</tr>
<tr>
<td>8</td>
<td>Secretaries, PAs, Administrative Assistants &amp; Office Support Staff</td>
</tr>
<tr>
<td>9</td>
<td><strong>IT Staff</strong></td>
</tr>
<tr>
<td>10</td>
<td>Production/Machine operators</td>
</tr>
</tbody>
</table>
ICT specialists shortage should result in:

- upward trend in job vacancy rates
- longer job vacancy duration
- increase in wages relative to productivity
Vacancy rates - ICT services to total business

Annual average of quarterly rates

Source: OECD 2015, based on PIAAC
Changes in wages relative to labour productivity

Annual averages 2001-2014
Online job vacancies

As a percentage of all online postings

Source: OECD, based on Burning Glass and Jobfeed
ICT vacancy duration

Median number of days

Source: OECD, based on Jobfeed
The demand for **ICT complementary skills**

- ICTs are changing the way work is carried out
- Demand for ICT complementary skills
- Ability to carry out work in a workplace shaped by ICTs, eg:
  - Higher frequency of information calls for better capability to plan in advance and to adjust quickly
  - More horizontal work organisation calls for more cooperation and stronger leadership
  - Wider diffusion of information among workers increases the importance of management and coordination
  - The sales skills in face-to-face commercial transaction are not the same as in an anonymous e-commerce sale
Tasks performed at work (PIAAC)

- **Cooperation:**
  - Cooperating or collaboration with co-workers

- **Horizontal interaction:**
  - Sharing work-related information with co-workers
  - Instructing, training or teaching people, individually or in groups
  - Making speeches or giving presentations in front of five or more people

- **Client interaction:**
  - Selling a product or a service
  - Advising people

- **Self-direction:**
  - Planning of own activities
  - Organising own time

- **Managerial tasks:**
  - Planning the activities of others

- **Influence:**
  - Persuading or influencing people
  - Negotiating with people inside or outside the organisation

- **Problem solving:**
  - Problem solving in less than 5 minutes
  - Thinking about a solution for a problem for at least 30 minutes

- **Physical tasks:**
  - Working physically

- **Skilled manual tasks:**
  - Using skill or accuracy with hands or fingers
## Correlations between ICT intensity and other tasks - OECD

<table>
<thead>
<tr>
<th>Cooperation</th>
<th>Collaboration</th>
</tr>
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<tbody>
<tr>
<td>Horizontal</td>
<td>Information sharing</td>
</tr>
<tr>
<td>interaction</td>
<td>Training others</td>
</tr>
<tr>
<td></td>
<td>Giving presentations</td>
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<tr>
<td>Client</td>
<td>Selling a product or service</td>
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<td>Planning of own activities</td>
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<td>Organising own time</td>
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<td>skills</td>
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</tr>
<tr>
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<td>Negotiating with people</td>
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<tr>
<td>Problem</td>
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<tr>
<td>solving</td>
<td>Thinking about a solution for at least 30 minutes</td>
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<td>Physical</td>
<td>Working physically</td>
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<td>skills</td>
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<td>Manual skills</td>
<td>Using skill or accuracy with hands or fingers</td>
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![Bar chart showing correlations](chart.png)
## Correlations between ICT intensity and other tasks – by education OECD

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<td>Working physically</td>
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<td>Manual skills</td>
<td>Using skill or accuracy with hands or fingers</td>
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</tbody>
</table>

**Graph:**
- High education
- Medium education
- Low education

The graph demonstrates the correlations between ICT intensity and other tasks classified by education levels (High, Medium, Low). The tasks include collaboration, horizontal interaction, client interaction, self-direction, managerial skills, influence, problem solving, physical skills, and manual skills. The correlation values are presented on a scale ranging from -0.4 to 0.4, indicating the strength and direction of the correlation.
Correlations between ICT intensity and cognitive skills – by education OECD
Lessons for ICT statistics?

- As ICTs diffuse to every field...
- ...every field will collect ICT information!
- Future of ICT statistics *with*...
- ICT & Health, ICT & Education, ICT & Business, etc.
- Less general ICT surveys, more specialised modules
- “If you want to measure ICT & ... here how you should do” – OECD ICT library
- Need to reach out to other stat/policy communities
An International Measurement Agenda

1. Improve the measurement of **ICT investment and** its link to **macroeconomic performance**;

2. Define and measure **skill needs for the digital economy**;

3. Develop metrics to monitor issues of **security, privacy and consumer protection**;

4. Promote the measurement of **ICT for social goals** and the impact of the digital economy on society;

5. Invest in a **comprehensive, high-quality data infrastructure** for measuring impacts; and

6. Build a statistical quality framework suited to exploiting the **Internet as a data source**.