Digital Transformation and employment in Italian enterprises

Andrea de Panizza & Stefano De Santis
This presentation: a work in progress, spanning across diverse topics

1. **Education**: predicts firms’ IT behaviour and performance, other things being equal
2. **IT adoption**: can be modelled, identifying patterns of digitalisation and enterprise profiles
3. **Employment dynamics**: strong quality differences depending on enterprise digitalisation
The digital transformation is moving fast...

Can be exemplified by the shares of ICT professionals in the economy and of employees using computers. Both items show a remarkable growth; Italy lags behind the EU, but the gap has been narrowing over time.

- **ICT specialists increased from 2.9 to 3.5 percent of workforce from 2011 to 2018 (3.8% in the EU28)**
- **48% of workers in firms w/10+ use a connected computer, up from 32% in 2009 (nearly 55% in the EU28)**

**Share of ICT professionals in total employment and employees using connected computers**

Sources: Istat and Eurostat LFS data (left); Eurostat, Community survey on ICT usage in enterprises (right).

NOTE: usage of connected computer refers to enterprises with at least 10 persons employed in manufacturing and market services, excluding finance.
... Although its spread varies greatly among enterprises

Industry and employment size make the difference, even for “mature” items

**IT uptake in EU28 enterprises, by size and industry. Year 2018 (or most recent available)**

Source: Eurostat, Community survey on ICT usage in enterprises
Education matters for IT behaviour (and performance) of firms

- In small firms, this holds true for both entrepreneurs and, especially, for employees.
- An additional year of education of the workforce increases the probability of using information management tools (ERP) by ca. 30%, after controlling for other factors.

**Effect of one additional year of education to firm’s average on the probability of using selected ITs**

Year 2015, Italian non-agricultural employer enterprises with less than 50 persons employed

Source: de Panizza and De Santis, 2018 (in Istat, *Rapporto sulla conoscenza 2018*).
Digitalisation patterns and enterprise profiles

Digitalisation of Italian enterprises. Year 2017; enterprises with 10+ persons employed in industry and market services

Factor space defined by IT uptake behaviour – size and industry position and enterprise clusters

Source: Authors’ computation on EC Survey on ICT usage in enterprises and Istat Statistical Archive on Active Enterprises (ASIA)
Digitalisation patterns and enterprise profiles

Digitalisation of Italian enterprises. Year 2017; enterprises with 10+ persons employed in industry and market services

Enterprises in factor space and cluster centroids

Source: Authors’ computation on EC Survey on ICT usage in enterprises and Istat Statistical Archive on Active Enterprises (ASIA)

Note: bubbles are computed for the 21 thousand enterprises in the ICT survey; their size shows each observation’s coefficient of expansion, so to portray the whole population of about 180 thousand enterprises.
Italy occupies an intermediate position between Poland and Sweden.

Highly digitalised enterprises tend to be larger and have a comparatively higher productivity.

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**Digitalisation of enterprises in Italy, Poland, Sweden and the UK. Year 2017.**

*Population and employment shares of enterprise clusters (% values), and labour productivity vs. low digitalisation (= 1.0)*

<table>
<thead>
<tr>
<th></th>
<th>Enterprises</th>
<th>Employment</th>
<th>Labour productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Low digitalisation</td>
<td>% Web oriented</td>
<td>% High digitalisation</td>
</tr>
<tr>
<td>POL</td>
<td>18.5</td>
<td>23.3</td>
<td>58.2</td>
</tr>
<tr>
<td>ITA</td>
<td>7.6</td>
<td>22.2</td>
<td>69.9</td>
</tr>
<tr>
<td>GBR</td>
<td>9.5</td>
<td>47.8</td>
<td>43.7</td>
</tr>
<tr>
<td>SWE</td>
<td>16.8</td>
<td>50.0</td>
<td>33.2</td>
</tr>
</tbody>
</table>


Note: populations of enterprises with at least 10 persons employed in manufacturing and market services, excluding financial activity. Relative labour productivity is computed as turnover per person employed except for Italy, where it portrays value added p.p.e.
Clusters are strongly characterized by IT uptake...

- In the highly digitalised cluster the diffusion of computers, IT tools and investment in IT related human capital are twice or three times the average.

- “Web oriented” enterprises (not very diverse from the low-digitalised ones in this respect) outline a soft digitalisation model, with little investment and need for training.

**Digitalisation models and the use of technologies - Year 2017. Percentage values by enterprise profile**

Source: Eurostat, Community survey on ICT usage in enterprises
• Larger endowments of physical and intangible capital concur to the productivity advantage of HD firms
• 2015 & 2016 similar employment growth in the three groups, but a very diverse quality composition (ISCO levels)

Structural features (left) and employment growth (right) by skill level in Italian enterprises, by cluster. Years 2014 to 2016

Source: Eurostat, Community survey on ICT usage in enterprises
Highly digitalised enterprises (in 2017) were characterised by a much higher diffusion of IT investment in the three preceding years, and give pay higher wages to their personnel, across most occupations

**web oriented** enterprises are also relatively more generous with employees and show a higher-than-average propensity to IT investment, but in specific fields only.
• High association (affinity) of investment in some tech clusters with technical profiles (e.g. software)
• Complementarity demand for more generic skills (e.g. “bureau employee”), at times adapted to technology (blue collars); some profiles highly mobile both in- and out-of employment

**Associations between IT investment clusters and professional profiles**

Grouped matrix of physical & human capital investment

<table>
<thead>
<tr>
<th>Reality Augmentata</th>
<th>Big Data, Analytics</th>
<th>Robotica</th>
<th>Social Media, Online Sales</th>
<th>Robotica</th>
<th>iOT</th>
<th>Reality Augmentata</th>
<th>Scienze Informatiche</th>
</tr>
</thead>
</table>

- Specialisti in scienze matematiche, informatiche, chimiche, fisiche e naturali
- Imprenditori, amministratori e direttori di grandi aziende
- Artigiani ed operai meccanici, specializzati e installatori e manutentori di attrezzature elettr.
- Specialisti in scienze umane, sociali, artistiche e gestionali
- Professionisti in campo scientifico, ingegneristico e della produzione
- Impiegati, addetti alla gestione amministrativa contabile e finanziaria
- Professionisti in campo scientifico, ingegneristico e della produzione
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Source: adapted from Istat (Rapporto Annuale 2019) based on the EU community survey on ICT usage in enterprises Istat Business register ASIA and Frame-SBS
In the years 2015 and 2016 qualified employment (ISCO 1 to 3) represented 16% of net job creation, with very broad regional differences.

These can be largely attributed to the presence of high-digitalisation enterprises.

**Net flows of highly qualified personnel**

*Years 2016 vs. 2014; % of total new net employment and contribution of highly digitalised enterprises*

Source: Authors' calculations on EC Community survey on ICT usage in enterprises and on Ministry of Labour Administrative records
That’s it... so far

Thank you for your attention

Andrea.depanizza@istat.it – Stefano.desantis@istat.it
Extra slides
From 2011 to 2016 education of persons employed grew about .4 years p.c., mostly *within* professions, and only to a limited extent due to changes in the employment structure.

People in employment are better educated in regions of the Centre (influenced by Rome) and less in regions of the South (mostly due to composition) and the Islands (mostly due to lower education in jobs).

**Differences in years of schooling of persons employed, by macro-region.**

*Years 2011-2016, total in years and components’ contribution*
Regional differences in (employment of) highly digitalised enterprises are crucial in hiring skilled workers.

- In Latium region close to 50% of workers are employed in HD enterprises.
- Shares are around 20-25% in regions of the North and Centre and go down below 10% in Mezzogiorno, where (partly as a consequence) the share of workers in web oriented enterprises is relatively high.

Source: Authors’ calculation on EC Survey on ICT usage in enterprises
The transition from low digitalisation to Web oriented: a multivariate (DM) analysis

<table>
<thead>
<tr>
<th>Tipo Imprese</th>
<th>addetti</th>
<th>fatturato</th>
<th>alfabetizzazione</th>
<th>k_add</th>
<th>VAPRO</th>
<th>% of persons employed</th>
<th>ICT specialists</th>
<th>ICT training for ICT specialists</th>
<th>ICT training for other persons employed</th>
<th>ERP</th>
<th>CRM for operational purposes</th>
<th>CRM for analytical purposes</th>
<th>Website with shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>nucleo &quot;duro&quot;</td>
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<td>9.722.963</td>
<td>10,3</td>
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<td>0,00</td>
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<td>0,07</td>
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<td>0,61</td>
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<tr>
<td>In transizione</td>
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<td>0,15</td>
<td>0,63</td>
<td>0,69</td>
<td>0,00</td>
</tr>
</tbody>
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Business unit classifier: a data mining application
The transition from low to high digitalisation: a multivariate (DM) analysis

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</tr>
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<tbody>
<tr>
<td>nucleo &quot;duro&quot;</td>
<td>66,7</td>
<td>11.278.650</td>
<td>10,4</td>
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<td>In transizione</td>
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<td>0,10</td>
<td>0,61</td>
<td>0,73</td>
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</tr>
</tbody>
</table>

Business unit classifier: a data mining application
Factors of digitalisation and innovative behaviour - a MV (DM) Analysis

Business unit classifier: a data mining application