Tracking the Digital Divide: Factor Analysis and Time Trends in Italian Firms

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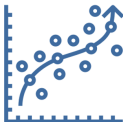
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Cumulative Dissertation

Chapter 1

*Bibliometric Analysis of European Research on Digital Divide:
An Exploration of the Corporate Landscape*

Chapter 2

*Adapting Van Dijk's Resources and Appropriations Theory:
Toward a Resources and Technology Integration Framework
at the Firm Level*

Chapter 3

*Tracking the Digital Divide: Factor Analysis and Time Trends
in Italian Firms*

1. Introduction

- DT play a pivotal role in reshaping business models (Trischler and Li-Ying, 2023) , driving innovation (Ciarli et al., 2021), and fostering competitive advantages (Jegan Joseph Jerome et al., 2024).

- The unequal adoption of DT has led to significant challenge: the digital divide.

- The digital divide at the firm level is a multifaceted gap characterized not only by disparities in access, skills and usage of DT, but also the derived benefits from different types of use.

- While the digital divide is a global issue, its impact on enterprises, especially in Italy, presents unique challenges and opportunities.

2. Objectives

- ▶ Explore changes over time in the digital divide, focusing on differences across firm sizes, sectors, and regions.

- ▶ Develop composite indices to track trends in the first and second-level digital divide.

- ▶ Evaluate the alignment of resources and technology integration theory with observed data.

- ▶ Propose targeted policy interventions based on research findings.

3. Data

- ▶ The dataset was derived from the ICT Usage in Enterprises Survey conducted annually between 2014 and 2019 by ISTAT.

- ▶ In total, 29 variables were used to extract three factors that represent the theoretical constructs.

    - ▶ Access index: 6 variables
    - ▶ Skills index: 9 variables
    - ▶ Usage index: 11 variables
    - ▶ **Control variable:** Firm size with three categories (small, medium, large)

- ▶ Considerations and Limitations.

    - ▶ Independence of Annual Data

- ▶ Data treatments, codes, and summary statistics, are available on my GitHub repository for replicability and further analysis.

4. Methodology

▶ The indices were constructed using dimensionality reduction
  techniques Factor Analysis for Mixed Data (FAMD) and
  Multiple Correspondence Analysis (MCA).

$$\text{Access Index}_i = \sum_{j=1}^{6} a_j \cdot X_{j,i} \cdot w_i$$

$$\text{Skills Index}_i = \sum_{k=1}^{9} b_k \cdot Y_{k,i} \cdot w_i$$

$$\text{Usage Index}_i = \sum_{m=1}^{11} c_m \cdot Z_{m,i} \cdot w_i$$

Where $\mathbf{X}$, $\mathbf{Y}$, and $\mathbf{Z}$ are the matrices of observations, $\mathbf{a}$, $\mathbf{b}$, and $\mathbf{c}$
are the vectors of weights derived from FAMD and MCA
contributions of each variable to the retained dimensions, and $\mathbf{w}$ is
the vector of weights accounting for the share of groups and years.

5. Results I

**Yearly Trends in Access vs Skills vs Usage**

Index ● Access ● Skills ● Usage
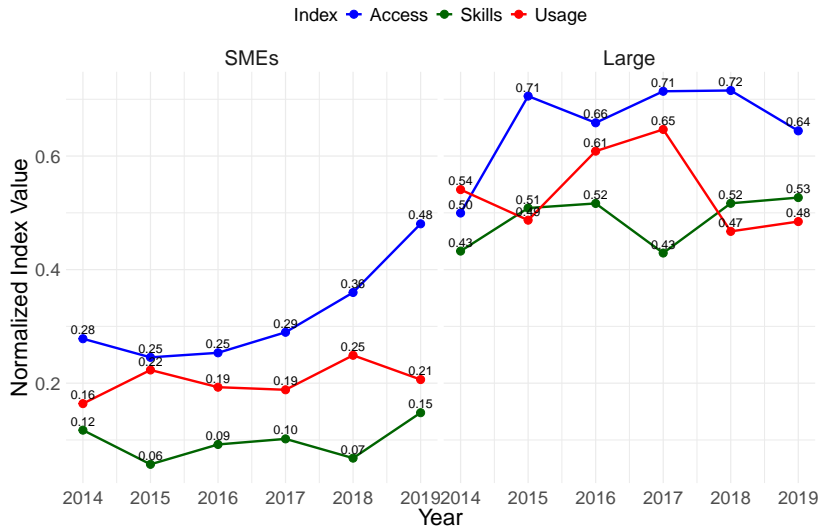
Key takeaways I

- While SMEs can maintain continuous growth in access, larger firms face different challenges.

- These findings align with Bratta et al. (2020), who discuss the hyper-depreciation measure issued in 2016.

- SMEs face more challenges in acquiring digital skills. There is a significant shortage of ICT graduates in Italy according to the "Digital Skills Observatory" in 2019.

- A higher usage index is present in SMEs as existing technologies need to be operated either by outsourcing digital skills or maximising the existing workforce.

5.1. Results II

**Yearly Trends in Access vs Skills vs Usage**

Index ● Access ● Skills ● Usage
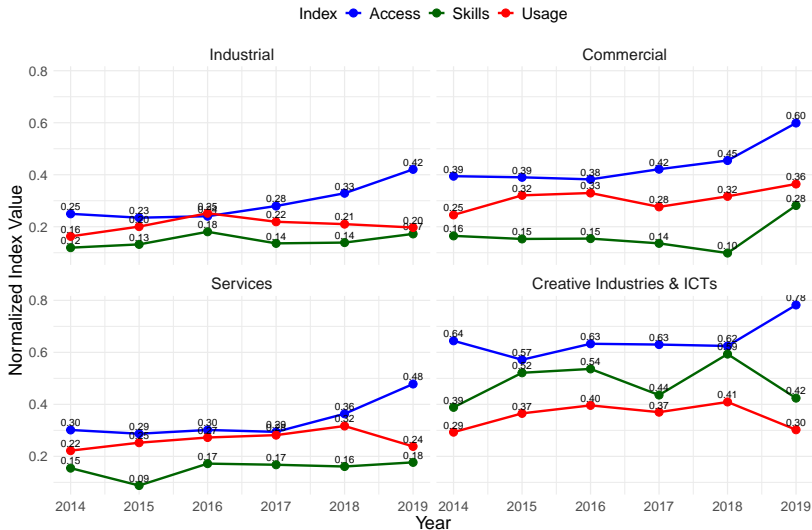
Key takeaways II

- ▶ Notable progress in digital access across sectors due to effective policy measures like hyper-depreciation.

- ▶ The digital skills index remains low, highlighting challenges in developing necessary competencies.

- ▶ Commercial, Industrial, Service Sectors: Growing digital access and stable usage, but significant skills gap.

- ▶ Creative Industries and ICT Sector: High levels of access and skills but moderate usage, reflecting different technological needs in workflows.

5.2. Results III

Yearly Trends in Access vs Skills vs Usage
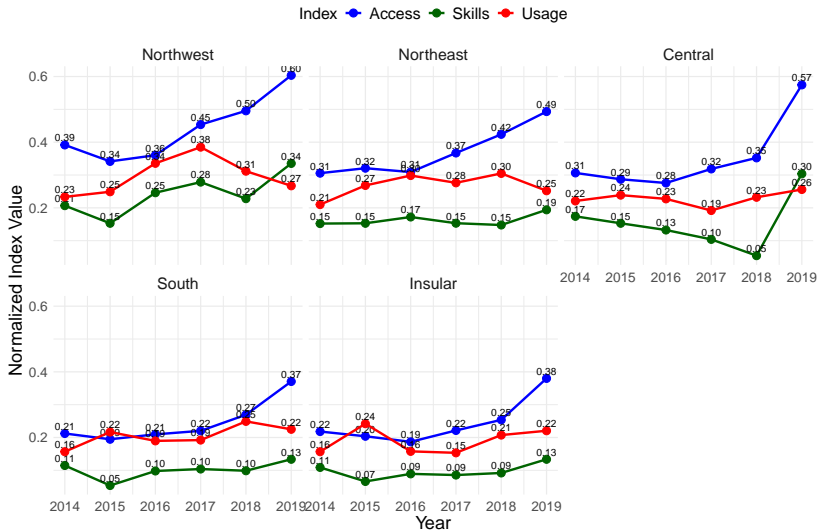
Key takeaways III

- Northern and Central Regions:
    - Significant improvements in digital access.
    - Benefits from robust industrial bases and policy interventions.
    - Persistent skills gap, slight increase towards the end.

- South and Insular Regions:
    - Lag behind in both access and skills. Reflecting systemic issues.
    - Need targeted policy efforts.

- Usage Trends:
    - Similar trends across regions.
    - DT integration driven by national policies, market forces, and sectoral requirements.

6. Q&A

Thank you for your attention

References I

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