

The Evolution of Required Skills in Italian Digital professional profiles: Soft Skills and Recruitment Dynamics

Paolo Mariani, Andrea Marletta, Daniele Pirotta, Mariangela Zenga

University of Milano-Bicocca

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- Introduction to the role of soft skills in Labor Market
- Methodology: three-way data and Weighted Factor Analysis with supplementary variables
- Application and results
- Conclusions and future works

Background

Access to the **labor market** is crucial for the meeting of supply and demand, with skills playing a key role in improving the competitiveness of businesses and employees, reshaping compensation structures.

In an innovation-driven environment, **soft skills** emerge as a response to the challenge of change, essential for mitigating the risk of skill obsolescence.

Analyzing the **relationship** between the **recruitment** process and the required skills is critical.

Context

This study uses an **Adecco Group** dataset of over one and a half million job placements across the main macro-sectors in Italy from 2016 to 2024.

Statistical units relating to candidates and the **soft skills** necessary for selection.

The analysis focuses on professional profiles within the "**IT and Digital**" sector, reclassified according to the ESCO definition as "Information and communications technology professionals".

Goal

This study explores trends and dynamics in recruitment processes and aims to define potential **career trajectories** for the professional roles in IT and Digital jobs.

Transformation of Multidimensional Data

Dataset consisting of variables for a group of three job profiles over the period (2016-2024) has been analyzed.

These data form a **multivariate time** array represented as X_{ijt} :

- i denotes a statistical unit (i.e., a job profile)
- j represents one of the required Skills
- t indicates an occasion (i.e., a year)

Transformation of Multidimensional Data

The observed values of the J variables on all I units in t are selected from the multivariate time array X_{ijt} thus obtaining a matrix which is called '**frontal slice**' (D'Urso and Vichi, 1998).

$$X^{(t)} = \begin{bmatrix} x_{1j}^{(t)} & x_{2j}^{(t)} & \cdots & x_{Jj}^{(t)} \\ \vdots & \vdots & \ddots & \vdots \\ x_{1J}^{(t)} & x_{2J}^{(t)} & \cdots & x_{JJ}^{(t)} \end{bmatrix}$$

where $X^{(t)}$ is a matrix including J variables observed on I units in t , with $t = 1, 2, \dots, T$.

Transformation of Multidimensional Data

Slices are stacked on top of each other to obtain the matrix with IT rows and J columns.

The matrix displaying the **time trajectory** of job profile i is obtained by selecting the J -dimensional vectors

$$\text{Time trajectory } \mathbf{X}_i = \begin{bmatrix} x_{i1}^{(1)} & x_{i2}^{(1)} & \cdots & x_{iJ}^{(1)} \\ x_{i1}^{(2)} & x_{i2}^{(2)} & \cdots & x_{iJ}^{(2)} \\ \vdots & \vdots & \ddots & \vdots \\ x_{i1}^{(T)} & x_{i2}^{(T)} & \cdots & x_{iJ}^{(T)} \end{bmatrix}$$

Transformation of Multidimensional Data

- To compare the time trajectories and to reduce the number of variables, the **Weighted Factorial Analysis** (WFA) can be used.
- The distribution of units at each time point can be visualized in the space defined by the first two **principal components**, i.e., the compromise plane (*Carlier, 1986; D'Urso and Vichi, 1998*).
- The **dynamic trajectory** of each unit can be represented by connecting the points across the different years (*Coppi and D'Urso, 2001; Liberati and Mariani, 2012*).

Supplementary Variables

- The innovation has been represented by the introduction of supplementary variables in the model (*Abdi, H., Williams, L. J. , 2010*).
- The **supplementary variables** are excluded by the phase of extraction of the factors and only successively, they are used by considering their position on the Cartesian plane as auxiliary interpretation for the analysis

Esco definitions

European Skills, Competences, Qualifications and Occupations (ESCO) definition of IT and Digital jobs profiles:

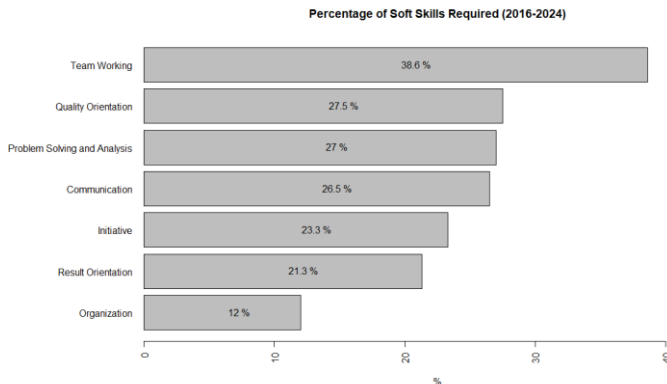
- Information and communications technology professionals (*Code 25*) conduct research; plan, design, write, test, provide advice and improve information technology systems, hardware, software and related concepts for specific applications; and design, develop, control, maintain and support databases and other information systems to ensure optimal performance and data integrity and security.
- Software and applications developers and analysts (*Code 251*) Systems Analysts, Software Developers, Web and Multimedia Developers, Applications Programmers.
- Database and network professionals (*Code 252*) Database Designers and Administrators, Systems Administrators, Computer Network Professionals.

The AdeccoGroup database

- The dataset used in this work was extracted from the database AdeccoGroup for 9 years (2016-2024).
- The **soft skills** analyzed were 7 and were selected from the 26 skills included in the Adecco Group's dictionary of skills by most frequency.
- The **supplementary variables** are socio-demographic: the age (classified in 4 age classes) and the education level (classified as secondary or tertiary education level).
- The job offers analyzed for the **IT and digital** sector are 1.646 belonging to ESCO 25 (84,3% ESCO 251, 15,7% ESCO 252).

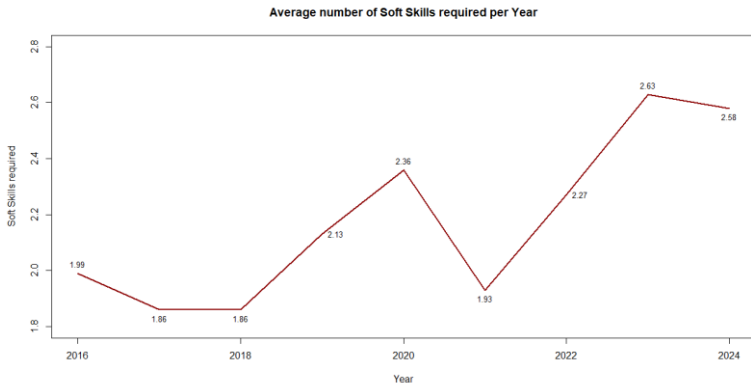
The Soft Skills

Frequency distribution of soft skills for It and Digital sector and trend over time



The Soft Skills

Frequency distribution of soft skills for It and Digital sector
and **trend over time**



Weighted Factor Analysis (WFA)

The application of **Weighted Factor Analysis** (WFA) allows for the identification of 4 potential findings:

1. Similarity between roles within the same sector
2. Identification of soft skill clusters
3. Association of professional roles with specific soft skills
4. Evolution of roles over the considered period using temporal trajectories

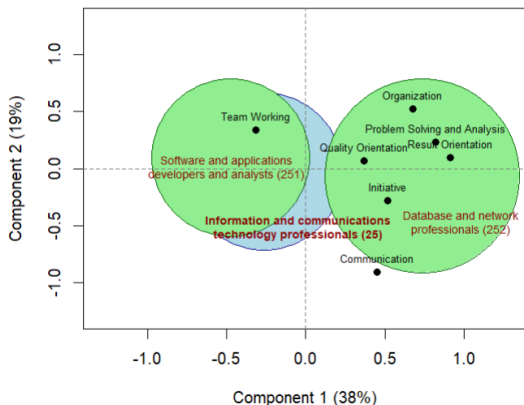
Weighted Factor Analysis (WFA)

The Weighted Factor Analysis was applied to the relative frequency distribution of 7 soft skills for each year and professional role, with the weight represented by the number of job offers, in order to capture 2 latent components by grouping the soft skills.

Soft Skill	PC1 (38.0%)	PC2 (19.2%)
Team Working	-0.316	0.335
Quality Orientation	0.368	0.070
Problem Solving and Analysis	0.816	0.229
Communication	0.447	-0.904
Initiative	0.514	-0.280
Result Orientation	0.913	0.100
Organization	0.677	0.520

A static representation

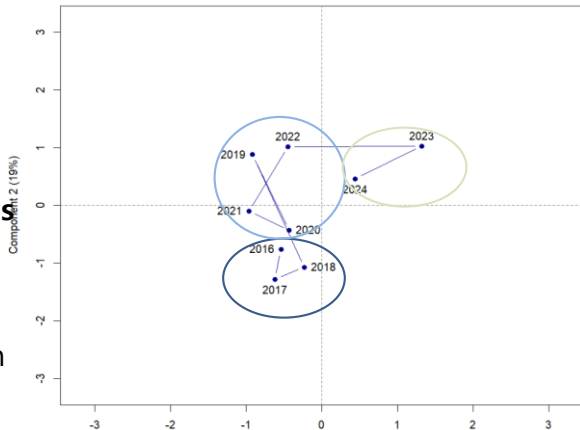
A **bubble** chart represents a static viewpoint based on the centroid of professional roles, without considering the trend of the entire time series.



The time trajectories for the job profiles

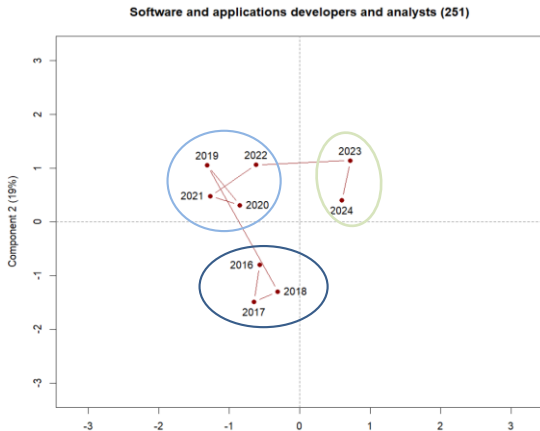
The trajectory for **Information and communications technology professionals** (Code 25) presents three clusters of years with a movement towards the right part of the Cartesian plan

Information and communications technology professionals (25)



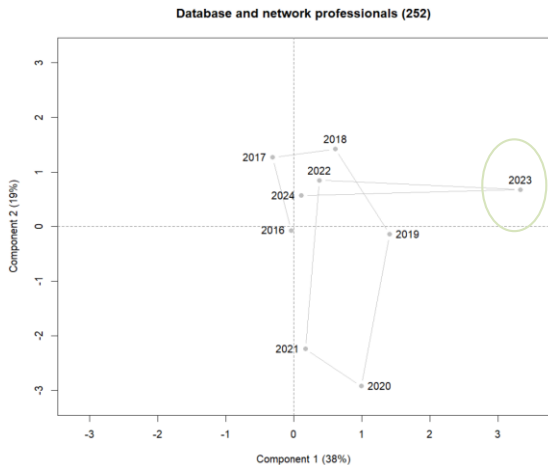
The time trajectories for the job profiles

The trajectory for **Software and applications developers and analysts** (Code 251) is similar to the previous one



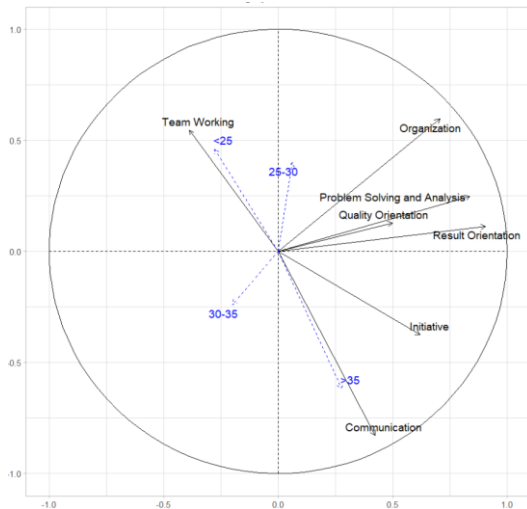
The time trajectories for the job profiles

The trajectory for **Database and network professionals** (Code 252) is quite different from the previous but even in this case, 2023 represents the year with the biggest value for the first component.



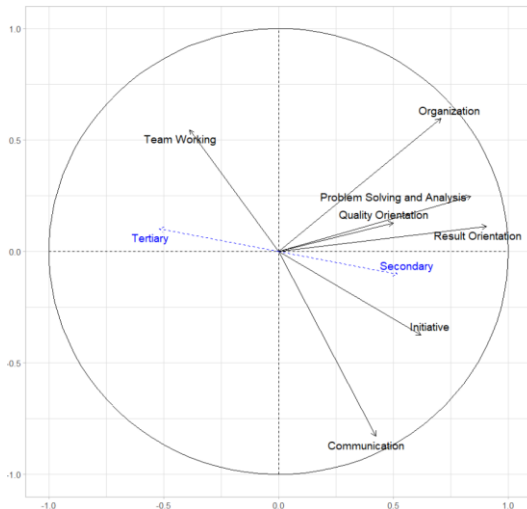
Supplementary Variables

The soft skills are represented jointly with the age classes underlining a contact point between the team working and the **youngest age** class and the communication and the **oldest** class.



Supplementary Variables

The soft skills are represented alongside education, highlighting a connection between Initiative and **Secondary Education**, and between Team Working and **Tertiary Education**.



Conclusions

- This study analyzed the **dynamic relationship** between professional figures and the **required skills** in the IT and Digital sector in Italy.
- Through the application of WFA to a dataset extracted from the Adecco Group database, significant trends and dynamics were identified in the recruitment process for three job profiles, at 2-levels, 2 and 3 digit of ESCO.
- The analysis underlined distinct trajectories and skill requirements over the years from 2016 to 2024: there is a transition **from collaborative and communication skills to organizational and methodological** skills aimed at achieving results.

Conclusions

- The analysis of **supplementary variables** allowed for the identification of specific skills required based on age and the level of education attained.
- At a younger **age**, teamwork skills are more commonly required, whereas the older age group tends to emphasize communication skills
- Individuals with a secondary **education** are more often expected to demonstrate initiative, while those with a university degree are increasingly sought for their ability to collaborate within teams.

Thank you for your attention