

Dynamics of IT and Digital Professional Profiles
in Italy: An analysis of the trajectories of required
soft skills

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Abstract Work, in an evolving context, influences production factors and labor force dynamics. 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 addressing the risk of skills obsolescence. Therefore, analyzing the relationship between the recruitment process and the required skills is critical. This study uses a dataset of over one and a half million job placements across the main macro-sectors in Italy (2016-2024), with 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."

Keywords: Labour Market, three-way analysis, time trajectories, supplementary variables

1. Introduction

Labour holds a pivotal role, impacting both production factors and workforce dynamics in both social and economic frameworks. Demand and supply are both involved in the access to the job market as a critical point. On demand side, economic conditions and technological advancements illustrate evolving roles and challenges in predicting future scenarios. Furthermore, on the supply side, the significance of skills, knowledge, and attitudes needs a depth-in-analysis on models and educational initiatives for their cultivation and application.

Projections from the World Economic Forum suggest a substantial proportion of employees seeking re-qualification by 2022, highlighting the importance of continuous learning and adaptation. Moreover, enterprises and employers, as emphasized by the International Labour Organization, are urged to invest in education and training to foster workforce development and support economic growth. Workers, too, are encouraged to take a proactive approach to skill development through ongoing training and education. Competencies are poised to play a central role in enhancing the competitiveness of both businesses and employees, potentially reshaping traditional remuneration structures.

This analysis draws on research conducted by The Adecco Group in Italy, exploring trends and dynamics in recruitment processes. In this context, this study aims to define potential career trajectories for various professional roles in IT and Digital jobs.

The paper is structured as follows: after the Introduction Section, in Section 2 the methodological approach has been presented, Section 3 is devoted to the application of technique to the Adecco Group dataset, finally in last Section, some preliminary conclusions will follow.

2. Methodology

In this study, a dataset consisting of variables for a group of four job profiles over the period from 2016 to 2024 has been analyzed. These data form a multivariate time array represented as X_{ijt} , where i denotes a statistical unit (i.e., a job profile), j represents one of the required skills, and t indicates an occasion (i.e., a year within the 2016-2024 period). Such three-way data can be rearranged [2,3,7] to reveal time trajectories, thus illustrating the paths of the job profile over time in a J -dimensional space. The data rearrangement comprises two steps. In the first step, the observed values of the J variables on all I units in t are selected from the multivariate time array X_{ijt} , thus obtaining an $I \times J$ matrix which is called 'frontal slice' :

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

where $X^{(t)}$ is an $I \times J$ matrix including J variables observed on I units in t , with $t = 1, 2, \dots, T$. Consequently, the multivariate time array X_{ijt} can be seen as a set of T slices. In the second step, slices are stacked on top of each other to obtain the $IT \times J$ matrix with IT rows and J columns.

The generic row of $X^{(t)}$, denoted by $\mathbf{x}_i^{(t)}$, contains the observed values for unit i in t :

$$\mathbf{x}_i^{(t)} = (x_{i1}^{(t)}, x_{i2}^{(t)}, \dots, x_{iJ}^{(t)}). \quad (2)$$

Considering that job profiles are the I units in this study, the matrix displaying the time trajectory of job profile i is obtained by selecting the J -dimensional vectors $\mathbf{x}_i^{(t)}$, with $t = 1, 2, \dots, T$, from X_{ijt} :

$$\text{Time trajectory } \mathbf{X}_i = \begin{bmatrix} x_{i1}^{(1)} & x_{i2}^{(1)} & \cdots & x_{iJ}^{(1)} \\ x_{i1}^{(2)} & x_{i2}^{(2)} & \cdots & x_{iJ}^{(2)} \\ \vdots & \vdots & \ddots & \vdots \\ x_{i1}^{(T)} & x_{i2}^{(T)} & \cdots & x_{iJ}^{(T)} \end{bmatrix}. \quad (3)$$

A time trajectory \mathbf{X}_i can be achieved for each job profile i , with $i = 1, 2, \dots, I$, and then such trajectories can be compared to detect the dissimilarities among job profile. To compare the time trajectories, the Weighted Factorial Analysis (WFA) can be used.

A similar procedure has been applied on a previous version of the same dataset for other professional figures in [6], respect to this study, the innovation has been represented by the introduction of supplementary variables in the model [1]. These 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.

3. An application on It and Digital sector

The dataset used in this study was extracted from the Adecco Group database for the years 2016 to 2024. Specifically, the statistical units are the candidates who have been awarded job offers, and the explanatory variables are the soft skills necessary to pass the recruitment process. The IT and Digital jobs profiles analyzed are three, as the European Skills, Competences, Qualifications and Occupations (ESCO) definition [4]:

- Information and communications technology professionals (Code 25): they conduct research; plan, design, write, test, provide advice and improve information technology systems, hardware, software and related concepts for specific applications; develop associated documentation including principles, policies and procedures; 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): they conduct research; plan, design, write, test, provide advice on and improve information technology systems such as hardware, software and other applications to meet specific requirements. Competent performance in most occupations in this sub-major group requires skills at the fourth ISCO skill level;
- Database and network professionals (Code 252): they design, develop, control, maintain and support the optimal performance and security of information technology systems and infrastructure, including databases, hardware and software, networks and operating systems.

The analyzed requirements were 7 and were selected from among the 26 skills included in the Adecco Group's skills dictionary, for these job profiles they are: Quality Orientation, Problem Solving and Analysis, Communication, Team Working, Initiative, Result Orientation, Organization. Using the proposed dataset, where $I = 3$ represents the number of professional figures, $X = 7$ denotes the number of soft skills, and $K = 9$ represents the years from 2016 to 2024. The supplementary variables are socio-demographic information about the employees, in particular the age (classified in 4 age classes) and the education level (classified as secondary or tertiary education level).

Before applying the methods presented in Section 2, some descriptive analysis are provided. The whole dataset is about a dataset of over one and a half million job placements across the main macro-sectors in Italy (2016-2024), with statistical units relating to candidates and the soft skills necessary for selection. The proposed approach is applied to the job offers of the IT and Digital sector with $n = 1,646$. In Figure 1, the descriptive statistics of the 7 soft skills are represented considering the frequency distribution and the trend over time.

Figure 1(a) shows Team Working as the most required competence and present in 38.6% of the job offers. This frequency distribution is based on the entire period from 2016 to 2024

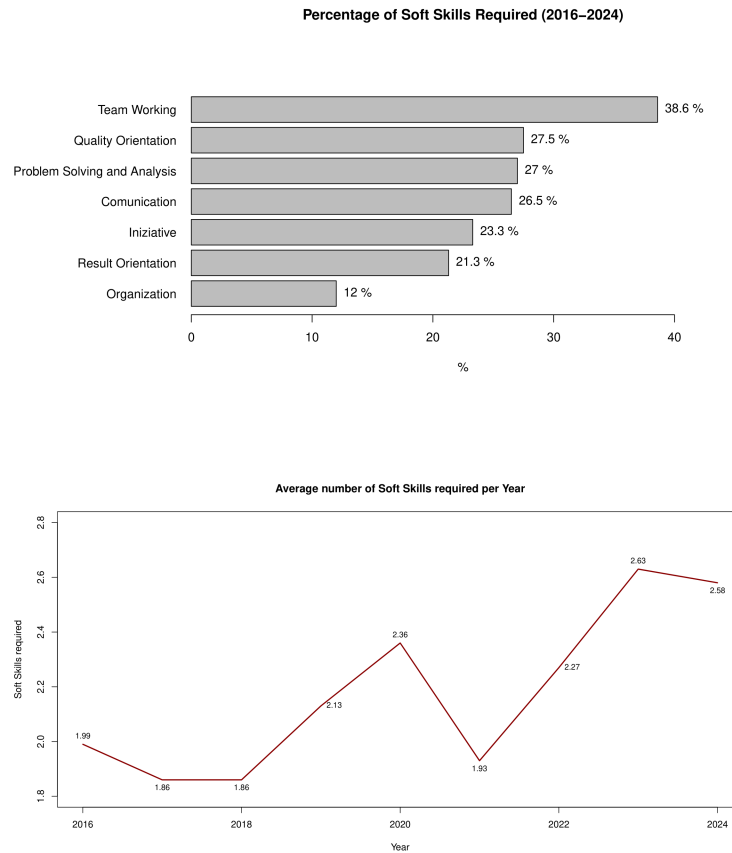


Figure 1: Frequency distribution of soft skills for It and Digital sector (a) and trend over time (b)

and this distribution is changing over time underlining an increasing trend of the required soft skills from 1.99 in 2016 to 2.58 in 2024 (see Figure 1(b)).

The proposed approach generates a weighted factor analysis explaining 58% of the total variance using the first 2 components. The time trajectories for the three considered job figures are represented in Figure 2.

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

Finally, since the approach proposed the introduction of the supplementary variables in the analysis, in figure 3, 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.

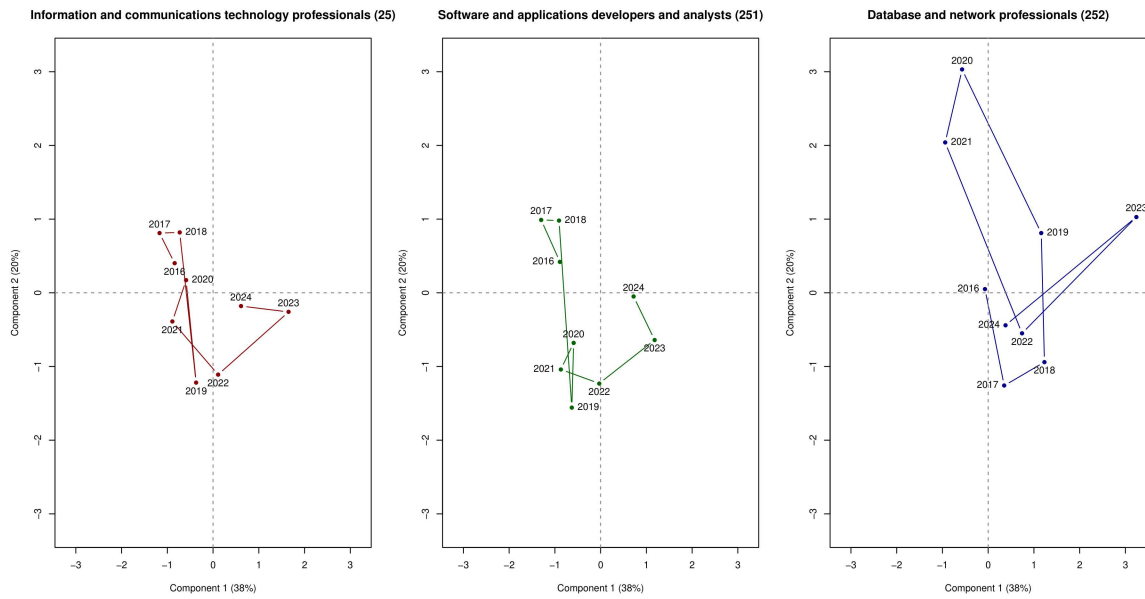


Figure 2: Time trajectories for It and Digital sector job profiles from 2016 to 2024

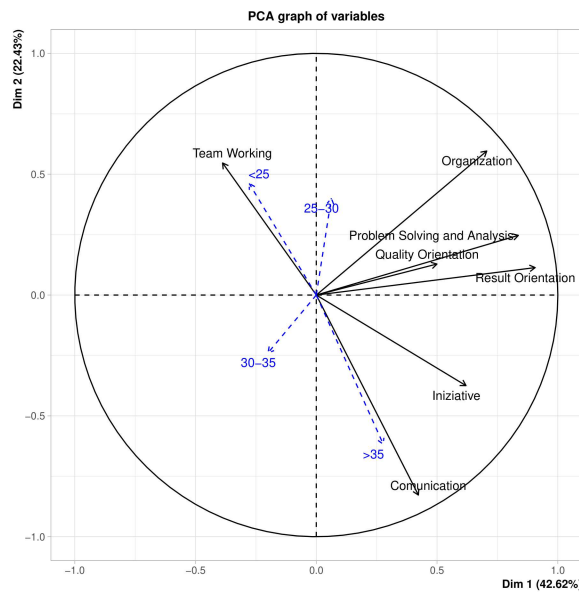


Figure 3: Joint representation of the soft skills and the age class of the employees for It and Digital sector job profiles from 2016 to 2024

4. 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 weighted factor analysis 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 (two and digit of ESCO classifications) namely Information and communications technology professionals

(Code 25), Software and applications developers and analysts (Code 251), Database and network professionals (Code 252). The analysis underlined distinct trajectories and skill requirements over the years from 2016 to 2024.

The findings indicate that the required soft skills for IT and Digital profiles vary across job roles and evolve over time. In general, over the years analyzed, there is a transition from collaborative skills (Communication and Team working) to organizational and methodological skills aimed at achieving results. Specifically, this shift is observed in three clusters: in the period 2016-2018, the emphasis was on the ability to work in a team; during the following four years (2019-2022), there was a decline in the focus on Teamworking in favour of problem-solving and result-oriented soft skills; and finally, in the last two years (2023-2024), there has been a growth in these transversal skills and a slight return to collaborative abilities. This trend may have been influenced by the rise of smart working in the labor market, particularly in IT and Digital roles.

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