

## **PUBLIC ADMINISTRATION LABOUR MARKET: SKILLS, DIGITAL INNOVATION AND TERRITORIAL DISPARITIES**

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**Abstract.** The digitalisation of public administration (PA) is essential for the modernisation of public services. Accelerated by the COVID-19 pandemic, it has led to the adoption of new technologies and organisational models, redefining the skills required of public servants. Human capital training is central to supporting digitalisation and enabling process simplification. The reform of the PA labour market, implemented under the NRP, aims to improve the skills of public employees and simplify processes through digital technologies. In addition, several programmes and initiatives promote the digital skills needed by the PA workforce. Despite the measures in place, there are differences between areas due to various factors such as the availability of resources, local initiatives and participation in tenders. The aim of this paper is to examine digital innovation in the public PA labour market, by analysing the strategies adopted to address new skills needs. This study is in continuity with a 2024 analysis that correlated digital innovation of firms and digital skills of workers, profiling regions according to the level of digitalisation of the labour market. This work constitutes a preliminary study for a multidimensional analysis aimed at outlining the digital profile of public institutions at regional level and understanding the role of territories in the digital transition. In terms of methodology, the study will be carried out through desk research, with an analysis of literature and policies implemented. In addition, a descriptive analysis will be carried out on the interventions for updating and retraining digital competences (Sources: ISTAT Census of Public Institutions and ICTPA Surveys). One of the expected results is the classification of the regions in terms of digital skills needs.

### **1. Introduction**

The 21st-century economy, shaped by globalisation and digitalisation, has transformed the labour market, introducing new organisational models and job profiles (Semenza, 2022). Digitalisation has shifted the skills required globally, increasing demand for digital competencies across all sectors, including public administration (PA). The COVID-19 pandemic accelerated this trend, prompting PA to adopt new technologies and redefine service delivery and employee skillsets. As Macri (2022) highlights, training human capital is key to digitalisation and process simplification. Various programmes, aim to improve public sector digital skills and streamline processes through technology. However, territorial disparities persist due to differences in resource access, local initiatives, and participation in tenders.

This paper builds on a 2024 study that examined regional disparities in digital innovation and labour market dynamics (Carta and Straccamore, 2024). The previous research developed three composite indicators to assess technology adoption by firms, workers' digital skills, and skill demand. Building on those findings, the current study serves as a preliminary step toward a broader, multidimensional and integrated analysis of labour market digitalisation across both public and private sectors, beginning with an assessment of digital skill needs.

Specifically, this paper aims to understanding how digitalisation is reshaping strategic choices and skill requirements in the public sector. Furthermore, using data from ISTAT, including the reports of Survey on information and communication technologies in local public administrations (2022)<sup>1</sup> and Permanent Census of Public Institutions (2022)<sup>2</sup>, the study outlines the digital profile of public institutions at the regional level and explores the role of territorial contexts in driving the digital transition. Finally, the research investigates the distribution of digital skills needs within public administration, drawing on simple indices based on selected indicators (ISTAT sources).

This study relies on desk research, combining a comparative analysis of academic literature and policy documents to explore digital innovation in public administration. The literature review examines scholarly works on three key areas: digital innovation, reforms in public sector governance, and the growing need for digital skills. These academic sources offer both theoretical frameworks and empirical evidence that help explain how digital transformation is reshaping the public administration (PA) sector. In parallel, the study analyses policy documents and strategic plans from different levels of government—national, regional, and local. This policy analysis reveals how various territories are addressing digital transition, emphasizing the development of digital competencies and assessing their institutional readiness to manage change. By integrating insights from both academic research and policy practice, the methodology provides a comprehensive understanding of how territorial dynamics and institutional strategies influence the implementation of digital innovation in public administration (sections 2,3,4).

The findings from the desk research contributed to defining the descriptive analysis areas and reformulating the research questions. The descriptive analysis was

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<sup>1</sup> The ISTAT survey 'Local Public Administration and ICT – Year 2022' concerns the statistical units made up of local administrations, namely: Regions and Autonomous Provinces; Provinces; Municipalities (of all demographic classes), Metropolitan Cities.

<sup>2</sup> The Permanent Census of Public Institutions conducted by ISTAT in 2022 has the following statistical units: Central administrations (Ministries, Presidency of the Council, National Agencies); Territorial entities (Regions, Provinces, Municipalities, Metropolitan Cities); Entities of the National Health Service; Non-economic public bodies; State educational institutions; State universities; Constitutional bodies and bodies of constitutional relevance; Armed forces and police; other public entities listed in the Public Institutions Register.

conducted through the identification and analysis of the reference statistical sources (more details in section 5), the construction of a conceptual framework and the development of three simple indices.

## **2. The Digital Transformation of the Italian Public Administration**

Starting with an analysis of the scientific literature on the topic, this session will present the evolution of digital regulations and the implementation of digital services in the process of digitalising public administration. Furthermore, it focuses specifically on the requirement for digital skills and the implementation of strategies and policies to enable effective digitalisation of the public sector.

### *2.1 Digital regulations and digital services*

The process of PA digitalisation in Italy, which has been evolving for over two decades, initially manifested more prominently in regulatory frameworks than in the tangible administrative landscape (Zappalà, 2024). The first regulatory foundations can be traced back to the 1990s, with Article 3-bis of Law 241 of 1990 on administrative procedure and the Bassanini Law of 1997, which introduced the principle of using telematic and IT tools to improve efficiency in internal relations, between administrations and with citizens (Zoppoli, 2024). Subsequent regulations, including the Stanca Directive of 2002, encouraged the adoption of digital signatures and online management of payments and communications, representing crucial steps in the digital transformation of the public sector. A major milestone came with Legislative Decree 82/2005, the Digital Administration Code (CAD), which established principles for interoperability and document dematerialisation, consolidating the legal framework for PA digital transformation (Zoppoli, 2024; Astrid, 2016). The 2010s saw acceleration with the creation of the Agency for Digital Italy (AgID) in 2012, tasked with coordinating national digitalisation efforts, and the launch of the Italian Digital Agenda aligned with EU strategies to promote digital infrastructure, e-government, and digital literacy (AgID, 2024). The Digital Growth Strategy (2014-2020) set priorities for digital PA, followed by the Three-Year Plan for IT in PA, regularly updated with the latest edition covering 2024-2026. This plan focuses on services, platforms, data, infrastructure, security, and interoperability, promoting tools like SPID (Public Digital Identity System), PagoPA, Electronic Identity Cards (CIE), and Electronic Health Records (EHR) (Agenda Digitale, 2022; AgID, 2024; Astrid, 2016). From 2021 to 2025, the Three-Year Plan incorporated operational tools, best practices, and checklists, emphasizing artificial intelligence, security, and interoperability. The 2025 Strategy for Technological Innovation and Digitalisation outlines future actions prioritizing accessibility and integration of digital services. Italy leads Europe in AI experiments and projects within PA but

faces challenges in digital skills and specialised training among the population (European Commission, 2024; Faraglia, 2023).

According to DESI 2024 data, Italy's digital public services have improved but remain below the EU average. Digital services availability rose slightly from 67.9% to 68.3% for citizens and from 74.7% to 76.3% for businesses between 2023 and 2024, still under the EU averages of 79.4% and 85.4%, respectively. Usage by citizens declined from 76.26% in 2023 to 68.53% in 2024, below the EU average of 75%. However, the government has advanced digital identity tools, with over 37 million active SPIDs and 39 million CIEs issued in 2023. (European Commission, 2024).

## *2.2 Civil servants and digital skills*

The scientific and institutional literature underscores the critical importance of civil servants' digital competencies in driving the successful digitalisation of public administration. These skills represent a key factor in accelerating digital transformation and improving service quality for citizens and businesses (Macrì, 2022). However, research highlights a widespread shortage of digital skills within the public workforce, stemming from inadequate updating of existing competencies and limited diversification of professional profiles. This persistent "skills gap" significantly hampers the full digital transformation of public administration (Bignotti, 2022; Bontempi, 2022). The development of civil servants' digital skills is closely linked to citizens' digital literacy, as both depend on the quality and effectiveness of public service digitalisation. To address this, national initiatives such as "Digital Republic" aim to reduce the cultural digital divide and foster digital inclusion. Despite recent progress, ISTAT and DESI data show that most Italian civil servants still have only basic digital skills. According to the ISTAT Report on Local Public Administration, in 2022, the utilisation of analogical tools (e.g. stamps, signatures and initials) in document protocol is expected to persist, with 89.1% of institutions still employing such methods. However, it is noteworthy that nearly half of these institutions will limit their use of analogical tools to specific sections of documentation.

Regarding the possession of digital skills, the Digital Decade Report 2025 shows that only 45.8% of Italians, including civil servants, have basic digital skills, which is below the EU average of 55.6%, placing Italy 23rd out of 27 EU countries in this regard. Additionally, pertinent are the findings of studies specifically designed to analyse the competencies of public sector employees. A 2024 Forum PA study highlights that 57% of public sector employees are highly exposed to AI, which could improve efficiency but also risk replacing workers with repetitive tasks. This emphasizes the need for continuous digital skills training to manage this technological shift effectively.

Moreover, the IFEL report (2025) identifies significant gaps between the digital skills required in Italian municipalities and those currently available. The report stresses the growing interconnection between technical and soft skills, noting that sustainable innovation demands strong leadership, strategic vision, and interpersonal abilities. For example, although 62% of respondents (managers and executives) show a strong result orientation, skills like leadership and conflict management are lacking, with nearly 20% of staff operating at entry level.

Expanding training catalogues and imposing more obligations is no longer sufficient. Learning models must evolve into non-linear, flexible, and personalised approaches, tailored to individual aptitudes and organisational contexts. Although the digital transformation of Italy's public administration is underway, significant concerns persist regarding employees' digital competencies and the continued reliance on analogue tools in administrative processes.

### *2.3 The implementation of strategies and policies*

Developing digital skills in Italy's public administration is a strategic priority for the digital transition. A growing gap between required and existing competencies among public employees is widely recognised at national and European levels, prompting policies and significant investment in digital training. The digital divide in public administration is not only technical but also cultural and organisational. As posited by the European Commission (2024), the integration of digital competences within a comprehensive change management framework is imperative to ensure the efficacy and sustainability of digital transformation over time. The "National e-skills strategy" is the all-encompassing reference framework in Italy. This initiative is part of a broader context, coordinating with European initiatives such as the "Digital Skills and Jobs Coalition", which aims to strengthen the digital skills of the workforce in all Member States.

The Italian strategy seeks to systematically overcome digital skill gaps by building a strong foundation for public workers to use digital technologies effectively. It is imperative that there is congruence between national and European strategies to circumvent the issue of fragmentation and to guarantee the uniformity of digital training plans (Van Deursen and Helsper, 2024). Furthermore, synergy between institutional levels speeds up the development of digital skills essential for smart and inclusive public services. The Department of Public Administration created the training platform "Syllabus of Digital Competences for PA," outlining essential digital skills organized by themes and proficiency levels. This instrument delineates a minimum set of fundamental digital competencies, meticulously organised in thematic domains and levels of mastery, that are deemed essential for every civil servant to acquire. Furthermore, the Syllabus provides a national framework for consistent digital training in public administrations.

Recent research highlights the importance of a clear and shared framework for digital skills, showing that common standards facilitate the assessment and customization of training (Carretero *et al.*, 2023). In this context, the Digi.Comp2.2 (Digital Competence Framework for Citizens) elaborated by the European Commission provides an updated, shared model for identifying and evaluating the digital competences needed by citizens.

The NRRP reinforces investment in digital training for public administration, emphasising long-term programmes to ensure transformation through human capital development. OECD (2024) stresses that substantial investment in digital skills is essential to optimise NRRP resources and strengthen institutional resilience. The Strategic Plan for Human Capital (2025) integrates digital, managerial, and organisational skills within a broader framework for workforce enhancement. Scholars confirm that innovation requires a multifaceted skillset, combining technical competencies with problem-solving, leadership, and adaptability (Koh *et al.*, 2024). Training delivery relies on e-learning for flexibility and accessibility, particularly after the health emergency. The goal is to establish a pervasive digital culture that supports technological innovation and continuous improvement of administrative processes. Recent studies highlight that adaptive e-learning and gamification significantly boost engagement and retention of digital skills (Sitzmann *et al.*, 2023), while analytics enable timely, targeted interventions.

### 3. The descriptive analysis: methodological approach and results

This paper continues the line of study initiated by the 2024 'Territorial Inequalities between Digital Innovation and the Labour Market' (Carta and Straccamore 2025). The 2024 study explored the link between companies' digital innovation and workforce digital skills, identifying regional trends and disparities. The Mazziotta-Pareto index methodology (Mazziotta and Pareto, 2022) was utilised to create three composite indices with the objective of profiling regional digital labour markets. These indices evaluated business adoption of technology, the skills of workers, and skills demand<sup>3</sup>. The results of the study indicated significant delays

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<sup>3</sup>Each index reflects different dimensions of analysis, and each dimension is measured by different elementary indicators:

The Business's Digitalization Index reflects the state of the digital transformation on the demand side and is measured by 7 indicators of the Istat 2023 survey "The Use of ICT by Businesses", with reference to enterprises with at least 10 employees.

The Labour Force Index measures the level of digital skills on the supply side<sup>3</sup> and is measured by 12 indicators (of the Istat 2023 survey "Aspects of Daily Life", with an ad hoc module on the use of digital technologies by citizens, and the Istat 2023 survey on "The Use of ICT by Businesses").

The Digital Skills Prediction Index provides another measure on the demand side, regarding the companies' forecasting needs for digital skills. This index consists of 3 indicators of the 2023 Unioncamere and Anpal survey "Demand Analysis of Digital Skills in Enterprises".

in Southern Italy, with considerable discrepancies between the demand and supply of digital skills in specific regions. Drawing upon the findings of that analysis, this paper presents a preliminary contribution to a broader multidimensional analysis aimed at mapping the digitalisation of the labour market across both public and private sectors. The study focuses on profiling the digital maturity of public institutions at the regional level. The analysis begins with an assessment of digital skill needs within public administration, using available data sources to explore their regional distribution. The skills need analysis constitutes the initial phase of a more in-depth and complex multidimensional analysis.

### *3.1 Methodological approach*

The examination of scientific literature and implemented policies, as described in sections 2, 3 and 4, in conjunction with the study of the available data sources, has led to the identification of three distinct dimensions of analysis. These dimensions are intended to facilitate the interception of the territorial distribution of e-skills needs in PA. The first dimension encompasses the training provided by PA in the domain of e-skills, thereby indicating the necessity for digital skills to be acquired or updated. The second dimension pertains to the utilisation of advanced technologies for data management and service delivery, thus signifying the extent of digitalisation within PA. The third dimension concerns the propensity to innovation, which is indicative of the inclination and tendency towards digital innovation. The initial supposition is that these three dimensions, when considered in relation to each other, can facilitate the identification of both differences and similarities in the digital skills requirements of public institutions at the territorial level. The analytical reading of territorial disparities is significant in order to be able to introduce tailored policies and interventions, adequate to counter and prevent further inequalities and disparities that may be exacerbated if the digital transition process is not adequately governed and if territories and citizens are left behind (OECD, 2023).

For each of the three dimensions identified, a reference index was constructed, consisting of elementary indicators (see Table 2):

- Training provided: the indicators selected are the courses provided by local administrations on ICT-related topics, from the most general to the most specific and/or relevant to the services provided by the administrations or to the performance of specific work activities (Table 2 from 'a' to "p"). A total number of 16 indicators were identified and the reference source is ISTAT - Survey on information and communication technologies in local public administrations - Year 2022 (see note 1).
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**Table 1** – *Indices, Selected Indicators, and Sources.*

Indices	Indicators	Source
Training provided	a) Operating systems	Source: ISTAT - Survey on information and communication technologies in local public administrations - Year 2022
	b) Specific applications and software	
	c) WEB	
	d) ICT security	
	e) Information systems and database management	
	f) Other (ICT courses)	
	g) Digitization of internal flows and processes	
	h) Web services, multimedia, social media	
	i) Cloud computing	
	j) Electronic payments	
	k) Open data	
	l) Electronic invoicing	
	m) Digital identity	
	n) Electronic procurement (eProcurement)	
Use of advanced technologies	o) Privacy, General Data Protection Regulation (GDPR)	ISTAT, Permanent Census of Public Institutions – Year 2022
	p) Enabling platforms provided by the ICT Three-Year Plan (PagoPA, ANPR, etc.)	
	q) Cloud computing services	
	r) Mobile applications	
	s) Internet of Things	
	t) Institutions that used social media	
	u) Institutions that analyzed large amounts of data (big data)	
Propensity for innovation	v) Institutions with interoperable databases and that adhere to the PDND	ISTAT, Permanent Census of Public Institutions – Year 2022
	w) Institutions with interoperable databases or to be made interoperable	

*Source: ISTAT*

- Use of advanced technologies: the indicators selected are given by the type of technologies used for data management and service delivery (Table 2 - ‘q’ to ‘s’), interaction with users using social media by type of membership (Table 2 - ‘t’) and the analysis of large amounts of information data (big data) from heterogeneous sources for analysis purposes (Table 2 - ‘u’). A total of 5

indicators were selected and the reference source is ISTAT, Permanent Census Public Institutions - Year 2022 (see note 2).

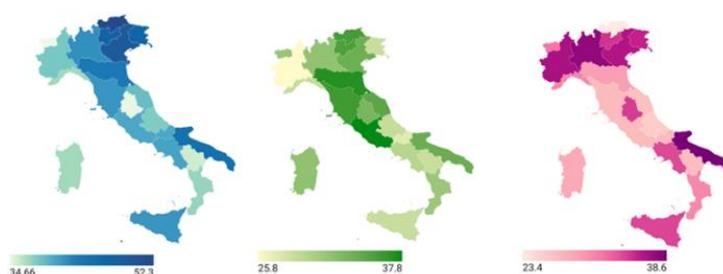
- Propensity for innovation: the selected indicators consist of the possession and use of interoperable databases, adherence to and orientation towards the National Digital Data Platform (PDND), and the ownership and use of databases that have been or could be made interoperable (Table 2 - “v” and “w”). Two indicators were chosen, and the reference source is ISTAT, Permanent Census of Public Institutions – Year 2022.

In this preliminary study phase, the arithmetic mean method was selected for building the indices because it represents the simplest and most used summary indicator to condense a set of quantitative data into a single representative value. The arithmetic mean, calculated as the sum of the values divided by the total number of observations, provides an intuitive and immediate measure of the central tendency of the data distribution, thus facilitating the interpretation and comparison of the indicators. This methodological choice allows for linear aggregation of data, ensuring easy interpretation of the results and guaranteeing that each indicator contributes equally to the formation of the overall index.

### 3.2 Results and evidence from the descriptive analysis

This section presents the main findings related to the three dimensions investigated. Figure 2 shows three maps of Italy highlighting the territorial distribution of each index, with a color gradient—from darker to lighter shades—indicating the intensity of the index (from higher to lower): the blue map represents “Training provided” (with values ranging from 34.6 to 52.3); the green one shows the “Use of advanced technologies” (from 25.8 to 37.8); and the pink one illustrates the “Propensity for innovation” (from 23.4 to 38.6).

**Figure 1** – Territorial distribution of the three indices. Training provided (blue); use of advanced technologies (green); propensity for innovation (pink).



Source: ISTAT 2022

At a glance, looking at all three maps, a polarization between northern and southern regions emerges across all three dimensions, with the north characterized by higher index values and the south by lower ones. Notable exceptions include the regions of Apulia, Piedmont, and Aosta Valley. Apulia stands out for high values across all three indices: training provided (44.4), use of advanced technologies (35.3), and propensity for innovation (38.6). This positioning reflects the Region's commitment to promoting digital training initiatives and adopting innovative technologies in administrative processes, in line with national programs and supported by the NRRP. In contrast, Piedmont and Aosta Valley record the lowest scores among the northern regions. Moreover, Piedmont shows the lowest value in the use of advanced technologies (25.8), and the Autonomous Province of Bolzano presents the lowest value for innovation propensity (23.4). These data suggest that, despite high performance levels in many areas of digitalisation, specific challenges remain in the adoption of advanced technologies and organizational innovation, likely linked to structural or cultural factors (Table 2).

**Table 2** – *Training Provided Index, Advanced Digital Technologies Usage Index, Innovation Propensity Index, by Region. Year 2022, Italy.*

REGIONS	Training provided	Use of Digital Advanced Technologies	Propensity Of Innovation
Lombardy	52,3	33,5	37,3
Autonomous Province of Trento	49	36,4	33,9
Apulia	44,4	35,3	38,6
Veneto	46,7	35,2	35,7
Emilia-Romagna	42,8	37,4	31
Tuscany	41,2	36,8	30
Lazio	40,1	37,8	30
Autonomous Province of Bolzano/Bozen	47,4	36,6	23,4
Sicily	41,2	31,2	33,5
Campania	40,4	31,9	33,4
Liguria	41,5	31,2	31,7
Marche	38,8	36	29,1
Umbria	34,8	34,7	33,7
Friuli Venezia Giulia	36,9	31,1	34,7
Calabria	37,2	33,1	31,6
Sardinia	36,9	33,6	30,6
Piedmont	38,1	25,8	36,2
AostaValley (or) Valled'Aosta/Vallée d'Aoste	34,7	33,2	32,2
Molise	40	28,7	29,9
Abruzzo	37,9	31,3	27,4

Although the general north-south divide is somewhat confirmed (with Lombardy and the Autonomous Province of Trento at the top of the regional ranking and Abruzzo and Basilicata at the bottom), these data highlight a more nuanced regional picture. Some southern regions (Apulia, Sicily, Campania) and central ones (Lazio and Tuscany) show significant progress in digitalisation and the development of digital skills, while some northern regions, despite overall strong performance, still face specific challenges related to innovation and the adoption of advanced technologies.

#### 4. Conclusion

Italy's PA digitalisation has advanced through regulatory, organisational, and technological reforms, improving efficiency and citizen focus. However, achieving full digitalisation of services remains challenging due to uneven innovation across institutions and territories. The NRRP and national strategies aim to address these gaps (Zappalà, 2024; Astrid, 2016; Faraglia, 2023). Literature agrees that enhancing public employees' digital skills is crucial, requiring structured investment in training, continuous updating, and new professional profiles, alongside citizen digital literacy policies. Current strategies adopt an integrated approach, combining standards, customised training paths, digital learning platforms, and strong financial and strategic support at national and EU levels. These measures are essential to guide PA through digital transformation, making it more efficient, transparent, and citizen oriented. Furthermore, the descriptive analyses reveal persistent territorial disparities, underscoring the need for targeted, region-specific policies to ensure an inclusive and uniform digital transition. Future research should explore the effectiveness of these strategies, the role of adaptive learning technologies, and the interplay between technical and soft skills in fostering sustainable innovation.

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