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ABSTRACT

Artificial intelligence (AI) is increasingly characterized as a General Purpose Technology (GPT) capable of reconfiguring work, accelerating digitalization, and raising aggregate productivity. Yet the pace and inclusiveness of AI adoption depend less on technical potential than on complementary sectoral capacity, institutional quality, and human capital. This paper examines Greece as a peripheral EU economy marked by high projected AI gains but significant structural constraints, generating risks of delayed adoption and uneven distributional outcomes. The paper develops a structural conversion framework linking three dimensions: capacity for AI-driven sectoral upgrading; institutional and functional readiness beyond digital infrastructure; and the regeneration and retention of skilled labour. Drawing on micro-level data from the JustReDI survey, the paper constructs composite indices of institutional trust, digital confidence, and digital public service usability, documenting substantial heterogeneity across educational subgroups and regions. The findings reveal a pronounced structural mismatch: service usability rises sharply with educational attainment, yet institutional trust varies only modestly, and digital confidence is performance-driven rather than legitimacy-based. A further tension emerges in Attica, where high institutional trust and technological centrality coexist with comparatively poor user-centric service quality. These results point to a fragmented digital transition marked by persistent social and regional asymmetries, suggesting that inclusive growth through AI adoption in structurally constrained economies requires a policy reorientation - from deployment toward the institutional and functional *conversion* of technological resources into broad-based development outcomes.

Keywords: Artificial Intelligence, Greek Economy, Digitalization, Human Capital, Brain Drain, Sectoral Transformation.

JEL Codes: O33, O38, O43, J24, R11.

1. Introduction

Artificial Intelligence (AI), and more recently, generative AI, are increasingly being positioned as a new technology that can reconfigure productive work and rapidly digitalize firms and states (Gao and Yu, 2024). But the potential to turn AI's technical promise into a persistent and inclusive development is highly uneven. Cross-national experience suggests that diffusion and impact depend less on the presence of technological opportunities, and more on institutional, sectoral, and human-capital enablers capable of scaling up adoption. This is particularly important for smaller, peripheral economies in the European Union (Horváth & Vicsek, 2023). AI paves the way out of long-standing productivity bottlenecks, while at the same time exposing structural weaknesses in governance, skills, and legitimacy.

Greece demonstrates just what this tension can look like. On one hand, large-scale adoption of AI could provide substantial macroeconomic benefits in the medium and long term. On the other hand, Greece is characterized by structural constraints that render these outcomes uncertain. The economy is largely service-oriented and fragmented, R&D activity is not robust, and small and medium enterprises (SMEs) are the dominant productive structure. Simultaneously, the sovereign debt crisis was linked to long-term exhaustion of a highly educated workforce through outward migration, decreasing the national density of skills and innovation networks needed for advanced technology upgrading. The result is a "delayed adoption" trajectory in which the expected returns from AI are only partially realized, mostly unevenly across sectors or geographical regions, and the gains from AI are not widely distributed (Subramanian & Hassan, 2024).

Another critical issue is that AI diffusion increasingly overlaps with digital governance. While public services, administrative activities, and policy provision are digitalized and AI systems are embedded in these infrastructures, adoption is a function based on the investment and regulation of technologies, but also on the institutional credibility and user experience necessary to harness and use AI-infused technology. This means that, from a science-technology-society perspective, AI adoption is not a purely supply-based technological process. It is also a socio-technical evolution affected by trust in institutions, perceived value, risks of

digitalization, and the access and usability of digital public services. When these dimensions are not aligned, technological upgrading creates frictions, uneven participation, and legitimacy deficits that limit implementation and slow diffusion.

The current paper contributes to the above discussion, building a structural description of the prospects of AI adoption in Greece, connecting three dimensions that were previously conceived and dealt separately: the capacity to transform, digital capability to deliver institutions and services, and the regeneration of human capital in the context of brain-drain. The main argument is that high projected macro-economic returns are not an absolute incentive for AI-driven growth in structurally constrained economies. What matters more is that complementary conditions must exist: a sectoral environment that can absorb and scale AI-intensive activities; an institutional architecture that is capable of coherent implementation, and a human capital base that can maintain upgrading instead of continuously leaking through skilled emigration.

On this premise, the paper proposes a structural conversion framework - drawing on the capability approach (Sen, 1999)- that clarifies how AI potential may be translated into (or fail to translate into) inclusive and sustainable growth. The empirical contribution supplements this structural account with micro-level evidence on the socio-institutional conditions of digital governance in Greece. Based on the dataset of the JustReDI survey by Papadoudis et al. (2025), the analysis creates three composite indicators covering unique but interrelated dimensions of citizens' interaction with the digital state: institutional trust, confidence in the digital system, and perceived ease of use of digital public services.

The analysis addresses four research questions. What structural factors can explain Greece's "delayed adoption" trajectory in AI, even though there are robust economic prospects? To what extent are institutional trust, digital confidence, and perceived use of digital public services disseminated across social groups and regions? Are these dimensions socially and regionally converging or diverging, and what are the structural tensions these two dimensions reveal regarding inclusive digital transformation? What do these socio-institutional conditions suggest for the design of AI and digital transformation strategies in structurally constrained, peripheral economies?

The rest of the paper is organized as follows. Section 2 presents the theoretical and analytical framework, situating Greece within the discourses of institutional capacity, general-purpose technology diffusion, and inclusive digital governance. Data and methodology are described in Section 3. Empirical results are reported in Section 4. Section 5 discusses the findings, and Section 6 summarizes the conclusions and provides implications for inclusive AI governance and structural policy design.

2. Theoretical and Analytical Framework

This section presents the theoretical framework of the paper by linking the general-purpose technology (GPT) literature with the absorptive capacity and institutional development perspectives. It claims that AI, as a transformative GPT, does not inherently facilitate inclusive growth, but its impact is contingent on the convergence of complementary institutional, sectoral, and human-capital conditions. First, it considers AI diffusion to be a conditional process, based on structural constraints. Second, it specifies three main channels for AI adoption, mediated by institutional capacity, digital service usability, and human capital density. Third, it applies this framework to the Greek case as an empirically relevant example of a structurally constrained economy. Finally, it offers a structural conversion framework that describes how technological promise can (or cannot) be translated into inclusive and sustained development outcomes.

2.1 Technological Change and Absorption in Structurally Constrained Economies

AI is a GPT having the ability to produce a transformative effect, complementing investments in organizational, institutional, and human capital (Gambacorta et al., 2025b). According to the basic definition of GPT theory (Bresnahan & Trajtenberg, 1995), they are pervasively implemented, continuously transforming over time, and possess strong innovational complementarities. Their economic value is because they can engender complementary innovations across sectors. Lipsey et al. (2005) also emphasize that GPTs have lengthy diffusion lags and need widespread co-invention, organizational restructuring, and institutional adaptation before their productivity impact starts to scale.

Under such a theoretical perspective, AI diffusion is treated as a conditional consequence, not an automatic process. GPTs will grow only when complementary assets -human capital, managerial capabilities, sectoral reorganization, and supportive institutional frameworks- are available. In structurally constrained economies that may lack such complementarities (where these relationships are weak or uneven), diffusion is slower and more asymmetric across sectors.

This form of conditionality is compatible with the absorptive capacity literature. Cohen and Levinthal (1990) describe absorptive capacity as the capacity of an organization to acquire new information from the external environment to recognize the value of the imported input, assimilate it, and use it for the purpose of commercial ends. Absorptive capacity is cumulative and path-dependent: it is influenced by prior related knowledge, investment in research and development (R&D), organizational learning procedures, and internal firm expertise diversity. It is a dynamic capability on which innovation and competitive advantage are based.

In this sense, the productive use of AI is determined not only by access to the technology itself but also by how well firms and institutions can integrate it into the business model and recombine it with sector-specific knowledge. In times of rapid technological transformation, organizations can encounter cognitive, managerial, or resource limitations that limit effective adoption; thus, absorptive capacity is not endless.

These theoretical insights are particularly relevant for structurally constrained economies where complementary capabilities remain unevenly distributed. The Greek case illustrates these dynamics clearly.

Challoumis and Eriotis's (2025) macroeconomic explanation, applying a multisector dynamic general equilibrium framework to the situation in Greece, shows that AI helps drive growth because it promotes the accumulation of capital stock and accelerates the growth of Total Factor Productivity (TFP). As in GPT theory, they involve “structural reallocation effects”: firms that successfully integrate AI grow relative to competitors, restructuring their output composition and competitiveness.

Larger businesses in Greece are more focused on AI adoption, as 24% of large companies are using AI, while the share of SMEs utilizing AI is only 13% (National Bank of Greece, 2025). There is also a significant mobility

within the services sector. Over 40% of SMEs in the services sector try out AI tools as compared to about 30% of SMEs in the industrial sector and the trade sector (National Bank of Greece, 2025). Macroeconomic impact is expected to focus on specific sectors, with 50% of GenAI's contribution coming from financial services, wholesale trade, manufacturing, professional services, and ICT (Deloitte & SEPE, 2023). At the household level, evidence from several Mediterranean economies indicates that adoption is mainly motivated by younger, better-educated individuals, particularly for information seeking and education (Gambacorta et al., 2025a). Sectors with higher knowledge content, digital intensity, or organizational flexibility tend to internalize AI more rapidly.

The transition also has labor market implications. 62% of employment in Greece is thought to complement AI, and only 6% is at high risk of its complete disappearance, but a critical "skills gap" exists (Implement Consulting Group, 2024). EKT (2021, 2025) points out the limited supply of professional ICTs and poor digital literacy as major obstacles, stating that many organizations faced difficulties in adapting during the COVID-19 crisis. Estimates present that the gap between demand and supply for ICT experts will be 83,000 persons by 2030 (Deloitte & SEPE, 2023). Within the absorptive capacity framework, human capital constitutes a core input into the recognition, assimilation, and exploitation of new knowledge. A shortage of ICT skills, therefore, directly constrains the economy's ability to convert technological availability into productivity gains. This also corresponds with wider European evidence that technology is transforming jobs, since routine activities can be automated, while demand for social and intellectual skills is increased (Fernández-Macías et al., 2025).

AI absorption is also complicated by institutional and regional issues. Most SMEs (60% of the total) do not adopt AI, indicating a digital maturity deficit (National Bank of Greece, 2025). The Greek government is already implementing reforms (KEPE, 2023), but Greece has not met international recommendations on "AI readiness," with respect to commercialization and research capacity (Schwaerzler et al., 2024; Hellenic Republic, 2024). As per GPT theory, without effective innovation systems and coordination mechanisms, complementarities are underutilized, and diffusion is fragmented (Yi et al., 2023). At the same time, the absorptive capacity literature emphasizes that institutional quality, inter-organization networks,

and learning infrastructures condition the speed and depth of knowledge diffusion.

Hence, the diffusion of AI in Greece is a socio-technical transformation where sectoral characteristics must correspond to the regeneration of human capital and institutional settings (Daskalakis et al., 2024). Access to the GPT is not the main challenge in structurally constrained economies. The main challenge is to create complementary capabilities that enable transformative potential.

2.2 AI Adoption, Institutional Capacity, and Inclusive Growth

Building on the GPT-complementarity argument, AI diffusion in structurally constrained economies can be understood as being conditioned through three interrelated channels: (i) institutional capacity and governance credibility, (ii) digital service usability as a demand-side precondition, and (iii) human capital density and retention. These channels specify the mechanisms through which complementary assets either enable or constrain inclusive AI-driven growth.

(i) Institutional Capacity and Governance Credibility

Institutional capacity is one of the most critical factors in successful AI utilization across sectors. According to Kim (2026), comparing similar AI systems in public administration has shown that the results vary based on data quality, regulatory framework, and bureaucratic maturity. For public sector integration to be successful, besides external regulatory pressure, there are also critical issues like leadership support, staff capability, and adaptive institutional capacity (Anomah, 2025). Moreover, AI could generate “endogenous institutional innovation” since the effects of technology on productivity are magnified when it is compatible with the existing digital service capacity (Zhang & Li, 2025).

Dependence on institutions is even more apparent in contexts where coordination and governance quality are decisive. Without a supportive institutional setting, AI adoption is fragmented and suboptimal (Jembu & Balang, 2025). The macroeconomic consequences of AI, particularly related to private investment, are also highly moderated by the quality of institutions. In high-quality institutional environments, the marginal

impact of AI adoption on private investment is more than doubled, whereas in poor-quality institutions, the impact is non-significant (Saif-Alyousfi & Alshammari, 2026).

Where institutional capacity is robust (in terms of regulatory clarity, bureaucratic maturity, leadership support, and governance credibility), AI adoption reinforces productivity, encourages complementary private investment, and generates endogenous institutional upgrading. In fragile institutional capacity environments, adoption remains isolated, trust in AI systems is limited, and macroeconomic spillovers are muted. Institutional trust may be more important for long-term consolidation than for short-term attitudinal alignment.

(ii) Digital Service Usability as a Demand-Side Precondition

AI diffusion is contingent on the usability and accessibility of digital services. Even when AI tools are available, their productive deployment needs a digital infrastructure that is interoperable, data systems that are dependable, and a user-centric design that reduces adoption costs.

Educators encounter numerous challenges, such as poor and expensive training and organizational inflexibility, which require significant investment in both funding and expert support to ensure access to education resources (Taheri et al., 2025; Rioseco País et al., 2025). Similarly, in the agricultural sector -especially in developing countries- AI implementation is neither efficient nor effective, because of inadequate rural infrastructure, low digital skills, and institutional disconnections (Huda et al., 2026). Institutional directives and mechanisms to build supportive frameworks are important to fill in these digital gaps and avoid falling behind vulnerable communities (Amouri et al., 2025; Sunmboye et al., 2025; Bianchini et al. 2025).

These findings indicate that digital usability is a demand-side complement: if digital infrastructures are accessible, cheap, and embedded in administrative and economic practices, then AI applications will more fully participate in productive routines. When usability is low, AI adoption is superficial and uneven across regions and social groups.

If digital services are usable and widely accessible, then they diffuse the adoption of AI more evenly and foster inclusive growth. When digital

divides exist, AI strengthens inequalities and remains focused on digitally advanced areas.

(iii) Human Capital Density and Retention

The third channel is about human capital density and retention. While AI implementation and acceptance can drive inclusive economic growth and economic sustainability, the repercussions of AI on the economy are not equally distributed. There is strong evidence that large firms in high-innovation countries benefit the most from AI-driven output growth as compared to smaller SMEs (Sun & Huang, 2026). Thus, there is a need for tailored policy frameworks to help promote equitable access (Fernandez & Uriarte, 2026).

In education, AI can make a huge impact on the learning process based on the unique needs of each student, provided that there is well-organized teacher training followed by data-governance tools (Altakhaineh et al., 2026). However, limited training capacity and institutional inflexibility constrain effective integration (Taheri et al., 2025; Rioseco País et al., 2025).

From a structural perspective, AI diffusion needs to keep highly educated and trained individuals within the economy. Especially when skills are scarce, and migration of high-skilled labour creates skills shortages, absorptive capacity is low. Human capital density, therefore, decides whether and how much AI complements the existing workforce or exacerbates the productivity gaps between firms and regions.

When a high level of human capital density exists, coupled with successful training and retention systems, AI adoption enhances the ability and productivity of innovators across regions. AI gains are limited when skilled labour is not available or unevenly distributed, allowing AI benefits to be concentrated in a few firms or sectors.

2.3 The Institutional Setting of the Greek Economy

Following the analytical framework developed above, Greece can be understood as a structurally constrained economy in which the diffusion of a general-purpose technology such as AI is conditioned by institutional

capacity, digital service usability, and human capital density. The Greek case, therefore, provides an empirical illustration of how weaknesses in complementary assets limit the realization of GPT-driven growth.

Technological transformation needs strong institutions. The rapid spread of new technologies such as AI in the Greek productive system is filtered through a complex grid of state capacity, sectoral arrangement, and human capital dynamics. The Greek technological evolution is limited by poor-quality institutions and an idiosyncratic governance system (Caramanis et al., 2015). This environment is deeply rooted in a history of systemic risk and recurring crises, and as such, a cultural profile defined by high uncertainty avoidance, loss aversion, and low interpersonal trust (Petrakis and Kostis, 2020a; Kafka, 2024). These cultural traits guide individuals into personal and institutional security rather than the "risky" path of innovation, anchoring the economy in stagnation (Petrakis and Kostis, 2020b). These structural characteristics lead to a chronic "reform capacity problem," where outdated perceptions among stakeholders and weak interaction between the state and the business ecosystem make policy interventions less effective (Stamopoulos et al., 2025). In addition, continuing overregulation and slow institutional reforms foster an environment in which high-tech investments are unattractive (Petrakis et al., 2023). In this idiosyncratic institutional setting, also characterized by judicial slowness and the presence of dominant oligopolistic sectors, long-term investment is discouraged, and entrepreneurs are incentivized to engage in "necessity-based" rather than "opportunity-based" entrepreneurship and innovation (Kostis, 2024).

From the perspective of institutional capacity and governance credibility, these characteristics weaken the complementarities required for AI diffusion. Although current usage of instruments like the Recovery and Resilience Facility (RRF) is working to reverse this setting and to function as a means of "proactive resilience" in relation to external shocks through targeted digital and green investments (Bartzokas et al., 2022; Bartzokas, 2026), initiatives such as "Greece 2.0" will be successful if they are backed by a strong regulatory framework and active collaboration between the government and the private sector (Stamopoulos et al., 2022). Historically, the state has struggled to prioritize digital infrastructure. In fact, the Greek economy remains "consumption-based," since consumption contributes approximately 65-70% of GDP (55% in the EU), while investment remains

low, inhibiting the development of a modern, knowledge-based production system (Kostis, 2026).

The structural constraints become visible when examining AI adoption. AI adoption in Greece is characterized as at a "delayed adoption" pace, despite some recent increase. In 2024, 9.8% of Greek firms employing 10 or more employees adopted AI applications, a significant increase from 4.0% in 2023, yet below the EU average of 13.5% (Greece in Figures, 2025). Economic potential is important: the widespread implementation of Generative AI (GenAI) is expected to increase Greece's annual GDP by €10-12 billion, with estimates indicating an approximate 6% increase within a decade (Implement Consulting Group, 2024). Under more aggressive "leapfrogging" scenarios where Greece speeds up adoption, economic growth due to GenAI is estimated at 8%, while a five-year delay is estimated to reduce the potential benefit to only 1% (Implement Consulting Group, 2024). Within 20 years, AI is expected to unlock productivity up 17.5%, more than the Internet's relative increase (Implement Consulting Group, 2024). These estimates mirror the divide between technological promise and structural readiness: We know there is an opportunity with respect to GPTs, but their realization depends on complementary institutional and productive capacities.

The structure of the productive system further constrains diffusion. The Greek economy is characterized by the domination of SMEs, which encounter obstacles to technological upgrading. Greek SMEs are lagging European SMEs, as it is difficult for them to adopt the latest technologies and engage with recent e-business practices due to their small size, low financial resources, and limited ability to take advantage of digital opportunities (Giotopoulos et al., 2017; Sarigiannidis & Chatzoglou, 2014). Most SMEs are family-owned, which serves as a substitute for a weak welfare state, offering social cohesion, but at the same time holding back and reducing labor to a few, low-risk, small businesses with low possibilities of efficient action (Petrakis et al., 2021). From the perspective of absorptive capacity and human capital density, SME dominance implies thinner internal R&D structures, lower experimentation capacity, and weaker integration of AI into productive routines.

The National Innovation System of Greece is characterized by low R&D intensity compared to other economies, especially regarding the business

sector. Contrary to most advanced economies, R&D in Greece is more likely to be driven by public entities and higher education institutions rather than by the private and industrial sector (Chrysomallidis and Tsakanikas 2017). Although total R&D expenditure reached a record 1.49% of GDP in 2023, this growth is not entirely justified by a structural shift to innovation but rather by the "mechanical" impact of the contraction of GDP during the crisis (Kostis, 2026). To confront this, the involvement of International Financial Institutions is critical for the green and digital transition (Bartzokas & Gómez Carrión, 2025; Bartzokas, 2026). The country ranks consistently among the lowest OECD countries in terms of innovation capacity and labor mobility (Gkypali et al., 2017). In addition, the R&D activity in the business sector is concentrated in a few high-tech sectors (e.g., pharmaceuticals and ICT services) and less in traditional sectors (e.g., agriculture and low-tech manufacturing) (Markaki & Papadakis, 2024).

Moreover, the economic crisis has caused a catastrophic long-run drain on highly educated labor. A high level of unemployment and a reduction in expenditure on research have created a "brain-drain" of high-skilled professionals, including professionals in STEM and medical fields, eroding domestic R&D capacity (Ifanti et al., 2014; Violakis & Tzakopoulos, 2024). According to Kostis (2026), the human capital crisis is aggravated due to a mismatch between sectors: although the number of researchers in the last decade has more than doubled, more than 50% of them remain in academic fields, while just 31.1% are found in businesses. This is a structural weakening of absorptive capacity: in the absence of a dense, business-embedded network of high-skilled labour, the domestic innovation ecosystem lacks the necessary "knowledge capital" to sustain advanced technological upgrading (Pavloudakis et al., 2023).

In addition, the institutional constraints vary across regions. Although the more advanced urban centres like Attica or Crete benefit from improved stakeholder networks and innovation platforms, less developed regions face institutional bottlenecks (Stamopoulos et al., 2025; Carayannis et al., 2026). Recent figures indicate that Attica accounts for more than 58% of the national R&D expenditure, confirming regional concentration and uneven dissemination, with a notable role given in the promotion of "Smart Specialization" projects (Kostis, 2026). However, effective regional upgrading is contingent on overcoming "path dependence" and promoting

sustainable integration between local R&D infrastructures and regional industrial producers (Tsipouri, 2017).

Greece embodies weak institutional credibility, asymmetric digital service capacities, SME dominated production structures, poor business R&D, and ongoing brain-drain. These factors condition the country's preparedness for AI-driven growth and explain why the realization of GPT potential remains slower and more fragmented than its projected macroeconomic benefits would suggest.

2.4 Toward a Structural Conversion Framework

From the preceding analysis, this paper develops a structural conversion framework linking digital readiness, sectoral transformation, and human capital regeneration. The main argument is that AI, as a GPT, is a structural opportunity whose developmental effects depend on specific conversion conditions. AI does not automatically lead to inclusive growth: it depends on the convergence of functional capability, institutional legitimacy, and human capital density.

Based on Amartya Sen's (1999) capability approach, the term "conversion" indicates when a resource is turned into valuable outcomes. Within this framework, AI is a technological resource, while institutional quality, usability of digital systems, and skill density are the conversion factors. Structural conversion, therefore, denotes the process through which technological potential becomes inclusive and sustained development.

These conversion factors do not operate symmetrically. For the Greek case, digital confidence is closely related to functional capability -represented by the usability and perceived quality of digital public services- while institutional trust serves a more restricted but statistically significant function. This means citizens' attitudes towards digital transformation are rooted more in performance than ideology. Where digital services are accessible, reliable, and user-oriented, digital confidence increases substantially, regardless of broader institutional skepticism.

Human capital density constitutes another major conversion channel. Educational attainment exhibits a robust and monotonic positive relationship with digital confidence, even after controlling for usability and

regional effects. The results provide empirical evidence that the impact of education on digital confidence occurs primarily through functional capability. Higher levels of education are positively related to perceived usability of digital public services, and this, in turn, significantly correlates with digital confidence. Human capital is thus an indirect conversion factor enhancing the capability dimension that mediates attitudinal alignment. This suggests that higher education enhances individuals' ability to internalize, evaluate, and productively engage with digital transformation. Thus, in structurally constrained economies, digital attitudes are mediated via absorptive capacity at the individual level, emphasizing the importance of upgrading and retaining skills.

Institutional legitimacy is important, too, but it is a much less effective conversion factor. Though the high levels of institutional trust are accompanied by higher digital confidence, their effect is less pronounced compared to usability or education. This asymmetry suggests that better digital service performance may enhance digital acceptance in moderate institutional trust settings. However, without institutional credibility, the long-term sustainability of digital transformation might prove fragile.

The analysis allows us to disentangle these dynamics analytically and separates the focus of these dynamics into two dimensions: (i) functional capability (usability and skills) and (ii) institutional legitimacy (trust and governance credibility). This leads to a different set of structures:

High capability - High legitimacy: Coherent digital conversion. Digital transformation is performance-driven and embedded in institutions. Therefore, it can lead to inclusive structural upgrading.

High capability - Low legitimacy: Technically effective but politically fragile conversion. Adoption occurs, but institutional skepticism may constrain long-term consolidation.

Low capability - High legitimacy: Trust without functionality. Digital transition is rhetorically supported, but in practice, it is constrained by usability and skill gaps.

Low capability - Low legitimacy: Structural misalignment. AI adoption continues to be uneven and exclusionary.

In Greece, digital confidence is mainly based on functional capability, while institutional legitimacy plays a less significant role. This is evidence

that structural conversion in smaller and institutionally constrained economies emerges primarily through performance-based channels rather than by broad trust. In such contexts, improving usability and increasing skill density can help generate digital acceptance even before full institutional consolidation.

The framework also generates three empirically supported propositions:

Proposition 1: In structurally constrained economies, digital confidence is more strongly associated with functional usability than with institutional trust.

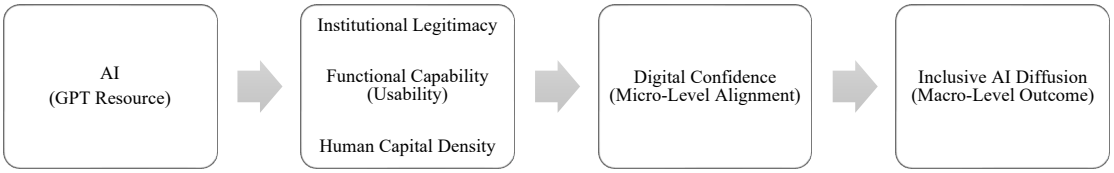
Proposition 2: Educational attainment is positively associated with digital confidence, indicating that individuals have more absorptive capacity.

Proposition 3: Regional diversity in digital confidence persists after controlling for usability and education, reflecting institutional and structural characteristics in specific regions.

The structural conversion framework serves as the analytical bridge connecting national-level macroeconomic predictions for AI-driven growth to the specific micro-level socio-institutional context empirically observed. It places Greece in the context of a wider theoretical analysis of how technologically backward, but institutionally reforming economies can translate digital potential into development through performance-based alignment of functional and human capital capabilities.

Figure 1 summarizes the structural conversion framework developed in this section. AI is conceptualized as a GPT resource whose developmental effects depend on the interaction between institutional legitimacy, functional capability, and human capital density. Digital confidence represents the micro-level attitudinal alignment through which inclusive AI diffusion becomes feasible.

Figure 1. Structural Conversion Framework



Source: Author's creation.

3. Methodology and Data

The empirical component of this paper is based exclusively on micro-level survey data from Greece and is designed to examine the socio-institutional conditions under which digital transformation -and by extension AI-related public policy- can be effectively implemented. The analysis does not aim at causal identification but at structural decomposition of associations. Rather, it maps structural patterns of trust, confidence, and service usability across social and territorial groups and identifies potential frictions that impact the legitimacy and inclusiveness of digital governance.

This approach reflects science, technology, and society perspectives that focus on the intermediary properties of institutions, social stratification, and user experience in technology change. To analyze the distributional asymmetries and mismatches that limit the potential of technology in the way that technology is mobilized into real-life outcomes, survey evidence is adopted as a diagnostic tool.

The analysis is based on the JustReDI survey (Papadoudis et al., 2025), an extensive study in Greece with 5,016 unweighted participants. The survey is nationally representative and covers a wide array of content, covering institutional trust, digital attitudes, and experiences related to digital public services.

Population survey weights, provided in the dataset (Weight_2), are employed to estimate based on the demographic composition of the Greek population and not of the raw sample distribution. Weighted estimates are reported for the national population as well as for key structural subgroups defined by educational attainment and NUTS-2 regions.

The empirical analysis proceeds in three steps. First, three composite indices are constructed capturing distinct but interrelated dimensions of citizens' relationship with the digital state: i) institutional trust, ii) digital

confidence, and iii) perceived usability of digital public services. Second, survey-weighted national means are computed for each index to establish aggregate benchmarks. Third, heterogeneity among education groups and among regions is explored by referring to gradients and territorial polarization instead of predicting individual differences.

Emphasis is given to cross-indicator comparison throughout the analysis. The aim is to determine the extent to which trust, confidence, and usability reinforce each other or diverge across social and regional lines and thereby uncover structural tensions pertinent to the design of digital and AI policies.

Before index construction, all responses coded as "99" (Don't know / No answer) were recoded as missing values. Indices were computed at the individual level using unweighted row means of available items, allowing for partial nonresponse. Composite measures were standardized using z-score normalization for comparability between indices or subgroups.

Institutional Trust Index (ITI)

Institutional trust is operationalized by nine survey items (see Appendix A, section A1) that assess respondents' trust in national government, regional and local authorities, businesses, NGOs, universities and research centers, the European Union, and the United Nations. Answers are recorded on a 1-10 ordinal scale, with higher values indicating greater trust. A raw Institutional Trust Index (ITI_raw) is computed as the unweighted row mean of all non-missing trust items. The index is then standardized across the full sample to produce ITI_z, with a mean zero and a standard deviation of one. As a robustness check, a principal component analysis (PCA) was also performed on the full set of trust items. The first component is highly correlated with ITI_raw, confirming the internal coherence of the index.

Digital Confidence Index (DCI)

Digital confidence captures citizens' perceived ease, usefulness, and societal value of digitalization (see Appendix A, section A2). The index is formed from three items: (1) perceived usefulness of digital services, (2) comfort with mandatory digital interactions, and (3) perceived future importance of digital technologies. Since the three items are measured

using ordinal scales with different ranges (1-3 and 1-4), each item was rescaled using min-max normalization so that all items range from 0 to 1, with higher values corresponding to more positive attitudes toward digitalization. This harmonization ensures comparability across items and prevents differential weighting due to scale length. The harmonized Digital Confidence Index (DCI_raw) is calculated as the unweighted row mean of the rescaled items. The index, therefore, ranges from 0 (fully negative attitude) to 1 (fully positive attitude). For comparability across indicators, a standardized version (DCI_z) is also computed using z-score normalization across the full sample. Higher values mean more positive attitudes about digitalization, perceived as performance-based assessments of digital service experience.

Digital Public Services Usability Index (DPSUI)

To capture citizens' lived experience with digital public services, the Digital Public Services Usability Index (DPSUI) is constructed, a multidimensional measure combining perceived obstacles and evaluations of service quality (see Appendix A, section A3). The index draws on nine survey items. Two binary variables measure the presence of obstacles to digital interaction: (a) requirements for personal digital equipment and (b) insufficient instructions. These variables are reverse-coded (higher values denote the lack of barriers). Seven Likert-type items are evaluated based on service attributes, such as efficiency, accessibility, reliability, security, ease of use, and perceived adequacy. The initial scale ranges from strong agreement (1) to strong disagreement (5). All items are reverse-scaled using the transformation:

$$\mathrm{rev}_i = 6 - \mathrm{raw}_i$$

so that higher values correspond to more positive evaluations. The raw DPSUI (DPSUI_raw) is the unweighted row mean for all valid reversed items. The standardized index DPSUI_z is then obtained through z-score normalization.

All descriptive statistics are computed using population weights. For all indices, presented above, weighted means, linearized standard errors, and

95% confidence intervals are reported. Two structural and subgroup analyses are made for each index: i) education attainment, which represents social stratification in digital capability and institutional participation. ii) NUTS-2 regions, to capture regional digital capacity and service delivery. These comparisons enable the identification of social gradients and divisions between different regions, which are essential for inclusive digital and AI-related policy implementation.

In addition to descriptive subgroup comparisons, pairwise correlation analysis is employed to examine the degree of association between institutional trust, digital confidence, and perceived usability of digital public services. Correlations are realized both nationwide and within educational and regional groups. This provides the capacity to find structural match or misfit of legitimacy with functional capability dimensions, in line with the structural conversion framework. Correlation analysis is reported descriptively, rather than by inferring cause and effect, as an indication of the level and direction of the relationship between main diagnostic components.

To evaluate the relative contribution of various structural drivers, survey-weighted ordinary least squares (OLS) models are constructed with digital confidence as the dependent variable. Independent variables are educational attainment, institutional trust, perceived usability of digital public services, and regional fixed effects. This enables an assessment of whether functional capability (usability), institutional legitimacy (trust), and human capital density (education) work independently or in combination in influencing digital attitudes. The purpose of this analysis is not causal identification, but robustness and structural decomposition of associations identified in descriptive comparisons. Digital confidence is modeled as the dependent variable because it represents the attitudinal alignment outcome within the structural conversion framework. Institutional trust and usability are treated as conversion dimensions rather than as endogenous outcomes in this specification. Accordingly, ITI and DPSUI are treated as explanatory conversion dimensions in this specification; modeling them as dependent variables would address different research questions (determinants of legitimacy and service evaluations), which are beyond the scope of this paper.

The empirical results are interpreted as evidence of the structural conditions on digital policy absorption rather than individuals' adoption attitude or causal determinants. The three indices reflect perceptions and experiences relevant to legitimacy and use (and therefore usability), not directly the performance of the system or the spread of the technology.

Although the survey serves as a strong mapping of heterogeneity between social and regional groups in Greece, the causal inference is beyond the scope of this study. The results should therefore be understood as diagnosing institutional and societal frictions that may hinder inclusive digital transformation, rather than as explaining individual-level decision-making.

4. Empirical Results

The analysis is descriptive and diagnostic, aiming to identify structural patterns and mismatches relevant for inclusive digital and AI-related policy design.

4.1 National-level benchmarks

At the national level, the three indices are close to the standardized mean, though not symmetrically. Institutional trust and digital public service usability are statistically indistinguishable from zero, implying broadly neutral aggregate evaluations. By contrast, digital confidence is slightly but statistically significantly below the standardized mean (Table 1), reflecting a modestly less favorable aggregate orientation toward digitalization at the national level.

These national benchmarks indicate neither uniformly high nor uniformly low evaluations of institutional trust, digital confidence, or digital public service usability in Greece. However, the proximity of the means to zero conceals substantial heterogeneity across social and regional groups, which becomes evident in the disaggregated analysis below.

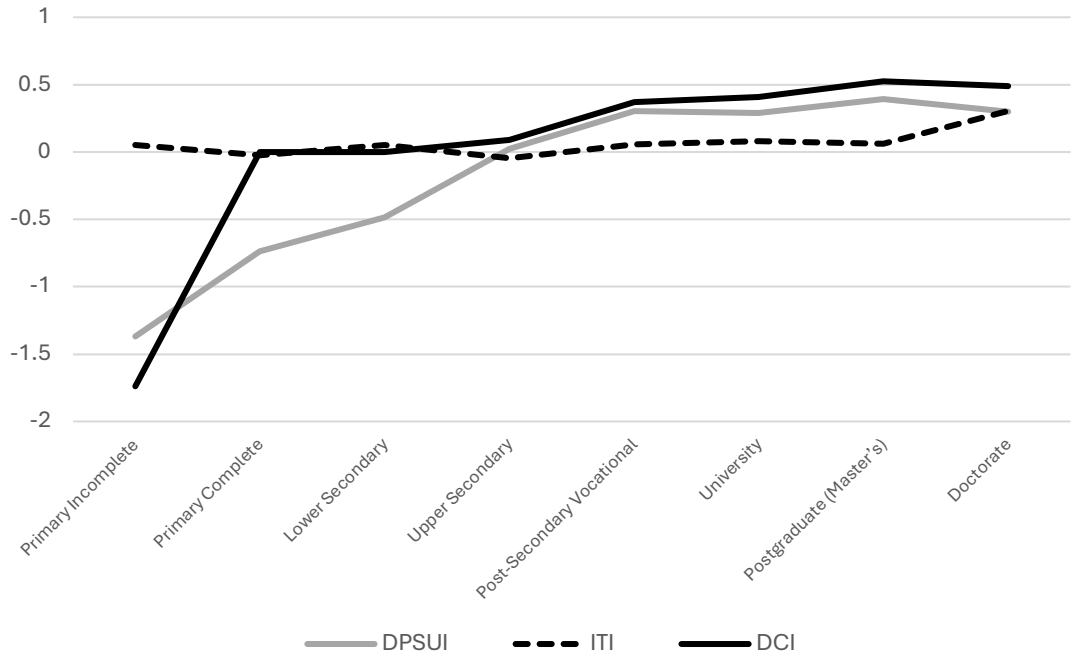
Table 1. National-Level Estimates of Institutional Trust, Digital Confidence, and Digital Public Service Usability

Index	Weighted Mean (Z-Score)	Standard Error	95% Confidence Interval	N (Unweighted)
Institutional Trust Index (ITI_Z)	0.015	0.0146	[-0.013, 0.044]	4,976
Digital Confidence Index (DCI_Z)	-0.045**	0.0157	[-0.076, -0.014]	5,002
Digital Public Services Usability Index (DPSUI_Z)	-0.016	0.015	[-0.046, 0.014]	4,995

Notes: Survey-weighted estimates using population weights (Weight_2). Indices are standardized (mean = 0, SD = 1). ** indicates statistical significance at the 5% level.

Figure 2 visualizes the educational gradient across the three standardized indices. There is a steep, monotonic increase for digital public service usability (DPSUI). This suggests substantial functional stratification in citizens' experience of digital public services. Institutional trust (ITI) remains comparatively flat, near the national average, with only a moderate increase among doctoral degree holders. Digital confidence (DCI) exhibits a strong positive gradient, rising systematically with educational attainment.

Figure 2. Socio-Institutional Indices by Educational Attainment



Source: Author's creation.

Notes: Survey-weighted means (Weight_2) of standardized indices (Z-scores). The horizontal dashed line at 0 denotes the national average. DPSUI_z rises steeply with education, DCI_z increases strongly and systematically, while ITI_z remains relatively close to the national mean with modest variation at higher education levels.

The figure, therefore, highlights a structurally stratified digital ecosystem rather than a divergence between confidence and capability. Usability and digital confidence rise markedly with education, and institutional trust exhibits only limited variation. This pattern suggests that citizens' confidence in digitalization is primarily aligned with functional capability and accumulated digital skills, rather than being driven by generalized institutional legitimacy.

4.2 Institutional trust: social and regional differentiation

Educational variation in institutional trust is modest but directionally uniform (Table 2). Only university graduates have a statistically significantly higher level of trust than the population average, with other educational groups clustering around the mean.

Table 2. Institutional Trust Index by Educational Attainment

Education Level	Mean (ITI_Z)	SE	95% CI
Primary Incomplete	0.052	0.148	[-0.24, 0.34]
Primary	-0.026	0.051	[-0.12, 0.07]
Lower Secondary	0.053	0.047	[-0.04, 0.15]
Upper Secondary	-0.046	0.023	[-0.09, 0.00]
Post-Secondary Vocational	0.055	0.042	[-0.03, 0.14]
University Degree	0.082**	0.029	[0.025, 0.138]
Master's Degree	0.063	0.061	[-0.056, 0.183]
Doctorate	0.305	0.225	[-0.137, 0.747]

Notes: ** indicates statistical significance at the 5% level. Survey-weighted estimates using population weights (Weight_2).

Regional variation in institutional trust is considerably stronger (Table 3). Trust levels are remarkably higher in Thessaly, Eastern Macedonia and Thrace, Crete, and Attica, while systematic trust levels are significantly lower in Western Macedonia, Epirus, Western Greece, and parts of

Northern Greece. This shows the regional character of institutional trust, which can further emphasize the unevenness of confidence in digital governance capacity.

Table 3. Institutional Trust Index by Region (NUTS-2)

Region	Mean (ITI_Z)	SE	95% CI
East Macedonia & Thrace	0.351**	0.063	[0.227, 0.474]
Central Macedonia	-0.286**	0.032	[-0.349, -0.224]
Western Macedonia	-0.637**	0.080	[-0.794, -0.481]
Epirus	-0.498**	0.056	[-0.608, -0.387]
Thessaly	0.537**	0.045	[0.449, 0.626]
Ionian Islands	0.091	0.118	[-0.14, 0.322]
Western Greece	-0.326**	0.054	[-0.432, -0.219]
Central Greece	-0.051	0.064	[-0.176, 0.075]
Peloponnese	-0.128**	0.061	[-0.247, -0.009]
Attica	0.138**	0.024	[0.091, 0.186]
North Aegean	-0.347**	0.118	[-0.578, -0.117]
South Aegean	0.171	0.097	[-0.020, 0.362]
Crete	0.327**	0.059	[0.210, 0.443]

Notes: ** indicates statistical significance at the 5% level. Survey-weighted estimates using population weights (Weight_2).

4.3 Digital confidence: A positive educational gradient

Digital confidence exhibits a pronounced and monotonic positive educational gradient. Table 4 shows a systematic increase in digital confidence based on educational level: for the least educated, digital confidence presents strong negative scores, while for the tertiary educated, it presents positive values.

Those with primary incomplete education and primary education have reported significantly less digital confidence than the national average (-1.739 and -1.350, respectively). Lower secondary education is still well below zero (-0.707). The index becomes positive at the upper secondary level (0.090) and increases further for post-secondary vocational (0.372) and university graduates (0.408). The highest scores are presented for Master's degree holders (0.525) and Doctorate holders (0.490).

Digital confidence is sensitively proportionate to the educational level and digital capability. Positive attitudes towards digitalization are skewed towards people with high formal education, indicating that their digital confidence is increased due to being comfortable with institutional

processes, digital abilities, and efficient navigation of digital systems. Rather than compensatory enthusiasm among digitally disadvantaged groups, confidence appears embedded in human capital density and functional competence.

Table 4. Digital Confidence Index by Educational Attainment

Education Level	Mean (DCI_Z)	SE	95% CI
Primary Incomplete	-1.739**	0.095	[-1.926, -1.552]
Primary	-1.350**	0.046	[-1.441, -1.259]
Lower Secondary	-0.707**	0.052	[-0.808, -0.606]
Upper Secondary	0.090**	0.022	[0.048, 0.133]
Post-Secondary Vocational	0.372**	0.030	[0.313, 0.431]
University Degree	0.408**	0.020	[0.369, 0.447]
Master's Degree	0.525**	0.029	[0.468, 0.583]
Doctorate	0.490**	0.097	[0.301, 0.679]

Notes: ** indicates statistical significance at the 5% level. Survey-weighted estimates using population weights (Weight_2).

Regional variation in digital confidence emerges as a heterogeneous but structurally coherent pattern (Table 5). Western Macedonia and the Peloponnese have significantly lower digital confidence, while Central Macedonia and the South Aegean exhibit significantly higher values. Although Attica's central administrative and technological role, it has digital confidence considerably below average. These results indicate that digital attitudes are not just the effects of administrative centrality and technological concentration but can instead vary by regional performance perceptions and lived digital experience.

Table 5. Digital Confidence Index by Region (NUTS-2)

Region	Mean (DCI_Z)	SE	95% CI
East Macedonia & Thrace	0.106	0.064	[-0.020, 0.232]
Central Macedonia	0.134**	0.035	[0.065, 0.202]
Western Macedonia	-0.386**	0.096	[-0.574, -0.199]
Epirus	-0.074	0.091	[-0.253, 0.105]
Thessaly	-0.067	0.057	[-0.180, 0.045]
Ionian Islands	0.025	0.116	[-0.202, 0.252]
Western Greece	-0.114	0.059	[-0.229, 0.002]
Central Greece	-0.073	0.066	[-0.202, 0.056]
Peloponnese	-0.406**	0.073	[-0.549, -0.264]
Attica	-0.106**	0.027	[-0.159, -0.052]
North Aegean	-0.037	0.109	[-0.251, 0.177]
South Aegean	0.201**	0.069	[0.065, 0.337]
Crete	0.121	0.063	[-0.003, 0.244]

Notes: ** indicates statistical significance at the 5% level. Survey-weighted estimates using population weights (Weight_2).

4.4 Digital public services usability: a strong educational divide

Educational differences reveal a strong monotonic gradient (Table 6). Lower-educated groups experience significantly lower usability, while evaluations become positive only above upper secondary education and peak among postgraduate degree holders.

Table 6. Digital Public Services Usability Index by Educational Attainment

Education Level	Mean (DPSUI_Z)	SE	95% CI
Primary Incomplete	-1.369**	0.197	[-1.756, -0.983]
Primary	-0.737**	0.062	[-0.859, -0.615]
Lower Secondary	-0.487**	0.050	[-0.584, -0.389]
Upper Secondary	0.025	0.021	[-0.017, 0.067]
Post-Secondary Vocational	0.303**	0.035	[0.235, 0.371]
University Degree	0.289**	0.023	[0.244, 0.334]
Master's Degree	0.393**	0.050	[0.296, 0.490]
Doctorate	0.299	0.165	[-0.024, 0.623]

Notes: ** indicates statistical significance at the 5% level. Survey-weighted estimates using population weights (Weight_2).

Usability also exhibits significant regional differences (Table 7); Central Macedonia, Crete, and South Aegean have the highest usability, and Peloponnese, Western Macedonia, and Western Greece have the lowest usability.

Table 7. Digital Public Services Usability Index by Region (NUTS-2)

Region	Mean (DPSUI_Z)	SE	95% CI
Central Macedonia	0.259**	0.036	[0.188, 0.329]
Crete	0.255**	0.047	[0.162, 0.348]
South Aegean	0.169**	0.072	[0.027, 0.311]
Central Greece	0.054	0.065	[-0.074, 0.182]
Epirus	-0.081	0.097	[-0.271, 0.108]
Eastern Macedonia & Thrace	-0.014	0.079	[-0.170, 0.141]
Ionian Islands	-0.045	0.106	[-0.253, 0.162]
Attica	-0.056**	0.024	[-0.104, -0.008]
Western Greece	-0.221**	0.049	[-0.317, -0.125]
Thessaly	-0.120**	0.051	[-0.220, -0.021]
Northern Aegean	-0.156	0.142	[-0.435, 0.122]
Peloponnese	-0.468**	0.072	[-0.610, -0.326]
Western Macedonia	-0.404**	0.127	[-0.652, -0.156]

Notes: ** indicates statistical significance at the 5% level. Survey-weighted estimates using population weights (Weight_2).

These results indicate a structurally stratified digital environment in Greece. Digital confidence and perceived usability increase monotonically with educational attainment across all educational categories, while institutional trust varies more moderately. Lower-educated groups have significantly lower digital confidence and much weaker usability evaluations. On the contrary, highly educated groups present high digital confidence and usability. Educational differentiation in institutional trust is limited compared to the other indices. This indicates that digital confidence strongly correlates with functional capability and increased human capital, not reflecting compensatory enthusiasm among digitally disadvantaged groups.

The findings indicate important regional asymmetries that inhibit inclusive digital and AI policy formation. Institutional trust is relatively high in Thessaly, Eastern Macedonia and Thrace, Crete and Attica, but relatively low in Western Macedonia, Epirus, Western Greece, the Peloponnese, and the North Aegean. Digital confidence and usability follow distinct regional patterns. Attica shows a distinct trust-usability discord: even though it has a relatively high institutional trust and a central administrative and technological position, it registers statistically negative usability assessments and below-average digital confidence. This structure implies that administrative centrality does not result in better user-centric digital performance. Since the data is cross-sectional and perception-based, the

mechanisms underlying it cannot be located. Explanations may include more administrative complexity as well as service congestion in the metropolitan region, higher expectations of more digitally literate users, mixed forms of interactions (integrating business-related processes), and survey compositional effects. The findings demonstrate a structural misalignment rather than a causal mechanism, thus emphasizing the role of regional institutional coherence in enabling inclusive digital and AI-driven transformations.

4.5 Cross-indicator alignment and structural consistency

To assess whether institutional trust, digital confidence, and digital public service usability develop together or independently, pairwise correlations at the national level and within educational and regional subgroups were computed.

On the national level (Table 8), digital confidence has a strong positive correlation with digital public service usability (r=0.569), indicating that a favorable user experience is closely associated with positive attitudes toward digitalization. Institutional trust is only weakly associated with both usability and digital confidence (r≈0.06) and implies that legitimacy and performance perceptions function as partially distinct dimensions.

Table 8. Pairwise Correlations Between Indices

	ITI	DCI	DPSUI
ITI	1.000		
DCI	0.057**	1.000	
DPSUI	0.058**	0.569***	1.000

Notes: Weighted Pearson correlations using population weights (Weight_2). N ranges from 4,966 to 5,002 depending on pairwise missingness. *** indicates statistical significance at the 1% level. ** indicates statistical significance at the 5% level.

Table 9 displays the cross-correlation by educational attainment in pairwise categories among the three indices. For all education groups, a positive association of digital public service usability and digital confidence is found, and a moderate-to-strong relationship from lower secondary

education upwards. The positive correlation is largest among the upper secondary and tertiary-educated respondents (r≈0.44-0.60).

Conversely, the relation between institutional trust and digital confidence is quite weak and inconsistent among groups, with coefficients nearly zero in most categories and varying signs among the lowest and highest education levels.

Table 9. Pairwise Correlations between indices by Educational Attainment

Education Level	ITI-DCI	ITI-DPSUI	DCI-DPSUI
Primary Incomplete	-0.049	0.060	0.074
Primary	0.059	-0.105	0.231
Lower Secondary	-0.017	-0.018	0.493
Upper Secondary	0.052	0.050	0.595
Post-Secondary Vocational	0.169	0.111	0.478
University Degree	0.090	0.178	0.466
Master's Degree	0.067	0.212	0.441
Doctorate	-0.322	0.091	0.552

Notes: Weighted Pearson correlations using population weights (Weight_2). Correlations are descriptive within-group associations. Category 99 (Don't know / No answer) excluded.

These subgroup patterns reinforce the national-level finding that digital confidence is primarily aligned with functional experience rather than generalized institutional legitimacy. The consistency of the DCI-DPSUI association across educational groups indicates that performance-based evaluation constitutes the dominant mechanism linking citizens' attitudes to their digital service experience.

To investigate whether there is a spatial variation between institutional trust, digital confidence, and digital public service usability, pairwise correlations were calculated within each NUTS-2 region (Table 10). This allows the identification of region-specific signals of structural coherence or misalignment between legitimacy (institutional trust) and functional capability (usability), and their joint association with digital confidence.

Table 10. Pairwise Correlations between indices by Region (NUTS-2)

Region	ITI-DCI	ITI-DPSUI	DCI-DPSUI
East Macedonia & Thrace	0.142	0.253	0.798
Central Macedonia	-0.056	-0.055	0.672
Western Macedonia	0.061	0.207	0.547
Epirus	0.225	0.160	0.510
Thessaly	0.142	0.017	0.609
Ionian Islands	0.169	0.178	0.366
Western Greece	-0.056	0.153	0.458
Central Greece	-0.054	-0.142	0.474
Peloponnese	0.065	0.118	0.581
Attica	0.075	0.076	0.523
North Aegean	0.120	-0.050	0.374
South Aegean	0.079	0.058	0.490
Crete	0.084	0.031	0.661

Notes: Weighted Pearson correlations using population weights (Weight_2). Correlations are descriptive within-group associations. Category 99 (Don't know / No answer) excluded.

Across all regions, the correlation between digital public service usability and digital confidence remains consistently positive and moderate to strong. This suggests that the performance-confidence alignment identified at the national level is territorially robust. Regardless of regional variation in institutional trust or overall development profiles, citizens' confidence in digitalization appears systematically associated with their lived experience of digital service usability.

By contrast, the correlation between institutional trust and digital confidence remains comparatively weak and unstable across regions. In several regions, the association is small or even slightly negative, indicating that higher levels of generalized institutional legitimacy do not necessarily translate into stronger digital confidence. Similarly, the relationship between institutional trust and usability varies substantially, suggesting that perceptions of institutional legitimacy and evaluations of digital performance operate as partially distinct dimensions of the socio-institutional environment.

The regional evidence reinforces the interpretation that digital confidence in Greece is primarily performance-driven rather than legitimacy-driven. While institutional trust may provide a background condition for governance stability, functional experience with digital public services

constitutes the more immediate and consistent determinant of citizens' digital attitudes across territorial contexts.

Multivariate estimates reported in Appendix Table A4 confirm that digital public service usability remains the strongest predictor of digital confidence when education and regional effects are jointly controlled for.

5. Discussion

The empirical findings provide a socio-institutional account of Greece's digital transition and its implications for AI absorption. Rather than revealing a contradiction between confidence and capability, the analysis demonstrates a structurally aligned but uneven digital ecosystem. Digital confidence increases with educational attainment and is strongly associated with perceived usability of digital public services, while institutional trust plays a comparatively modest role.

Greece's digital transformation is more capability-driven and performance-mediated, rather than legitimacy-driven. The implications for AI governance are about facing structural inequalities in digital competence and service experience.

5.1 Human Capital and the Structuring of Digital Confidence

The most consistent pattern across the analysis is the strong educational gradient observed in both digital confidence (DCI) and digital public service usability (DPSUI). From primary incomplete education to postgraduate levels, both indices increase monotonically. Lower-educated groups report substantially negative standardized scores, while tertiary-educated respondents display clearly positive values.

This places Greece in a context where disparities exist not in access but in skills, navigation capacity, and efficient use. Education functions as a structural conversion factor by enhancing citizens' ability to navigate and evaluate digital systems. Its effect on digital confidence appears to be mediated by functional capability, as reflected in the strong association between usability and confidence.

Digital confidence does not appear as compensatory optimism among digitally disadvantaged groups. Instead, it closely tracks usability and

educational positioning. Higher education is not only an indicator of technical literacy but also provides greater familiarity with bureaucratic procedures, improved institutional navigation skills, and more exposure to digitally mediated environments.

For AI policy, this implies that absorptive capacity is not evenly distributed among the population. Without specific interventions, an advanced AI system built on existing infrastructure may more likely favour the already-capable users while deepening exclusion among the lower-educated groups.

5.2 Performance Over Legitimacy

The correlation analysis supports a key finding that digital confidence is strongly correlated with usability and weakly linked with institutional trust. This seems to hold across educational subgroups.

It seems individuals evaluate digitalization pragmatically. Confidence is built when digital services are efficient, accessible, and reliable. Institutional legitimacy is not irrelevant, but it is not the primary driver for digital attitudes.

This supports the view that Greece's digital transition functions within a model of performance-based legitimacy. The functional relationship with the government -rather than just the trust in political or administrative institutions- shapes attitudinal alignment with digitalization.

This has important implications for AI governance. Acceptance of AI-enabled public services is less dependent on the ideological pressure to believe in AI and more on user experience. If AI applications reduce frictions, simplify procedures, and improve transparency, confidence is likely to follow, even in environments where institutional trust remains moderate.

5.3 Regional Fragmentation and Institutional Coherence

In addition to educational stratification, the analysis shows strong regional asymmetries. Some regions (e.g., Central Macedonia, Crete) show a relatively cohesive association between trust, usability, and confidence. Others display misalignment.

Attica, Greece's administrative and technological center, presents good institutional trust but below-average usability and slightly negative digital confidence. That might indicate that infrastructural concentration does not automatically translate into user experience. This metropolitan centralization-performance tension might mirror administrative congestion, higher service complexity, or elevated expectations among a digitally literate population. Regardless of the mechanism, it highlights a centralization-capability tension: digital governance capacity cannot be inferred solely from institutional density or technological infrastructure.

From an AI perspective, regional institutional coherence appears critical. Where usability, confidence, and trust align, AI integration is likely to encounter fewer frictions. Where they diverge, diffusion may stall -not because of resistance to innovation, but because of weak functional foundations.

5.4 Structural Conversion and Conditional AI Absorption

Taken together, the findings validate and refine the structural conversion framework. The evidence confirms that in structurally constrained economies; (a) Human capital density strongly conditions digital confidence. (b) Functional usability is a key mediator of attitudinal alignment. (c) Institutional trust operates as a secondary, partially decoupled dimension. (d) Regional institutional coherence shapes the territorial distribution of absorptive capacity.

Greece's digital ecosystem, therefore, appears neither uniformly weak nor uniformly advanced. It is internally stratified. The high-capability groups have strong usability and confidence, whereas the low-capability groups have significant functional barriers that suppress confidence.

The AI adoption implications are evident: technological availability by itself is not enough. The conversion of AI into inclusive productivity gains depends on whether usability and digital competence are sufficiently diffused across social and regional contexts. Without better functional accessibility, AI could risk reinforcing existing structural inequalities rather than mitigating them.

The findings refine the GPT-diffusion argument for structurally constrained economies. The Greek case suggests that performance-based

functional capability may precede or partially substitute for generalized institutional legitimacy in shaping digital attitudes. This does not eliminate the importance of trust for long-term consolidation, but it indicates that short- to medium-term alignment in digital transitions may be driven primarily by user experience and skill density.

6. Conclusions and Policy Implications

The examination of digital transformation in Greece as a precursor to AI absorption reveals that technological potential is not an automatic byproduct of deployment. Instead, the realization of a GPT's impact is a conditional process mediated by functional capability, institutional legitimacy, and human capital density. This study's structural conversion framework demonstrates that Greece currently faces a socially and regionally stratified transition in which digital confidence is primarily performance-driven rather than ideologically anchored. The evidence does not indicate systemic digital incapacity. Instead, it suggests segmented conversion capacity: high-capability groups and regions can convert digital infrastructure into a positive attitudinal alignment, while low-capability groups experience functional constraints that suppress confidence.

Citizens' support for digitalization is predicated on the tangible usability of services rather than generalized trust in institutions. The empirical evidence strongly supports Propositions 1 and 2 and partially supports Proposition 3 —confirming that in structurally constrained economies, digital confidence is more robustly associated with functional usability and educational attainment than with generalized institutional trust. Meanwhile, the data indicate the need for an important refinement of the framework: institutional trust and functional capability might develop at different paces, resulting in structural configurations that continue to sustain digital confidence even in the presence of moderate or uneven institutional legitimacy.

Regional analysis points to a critical structural challenge through geographical fragmentation. The centralization-capability tension observed in Attica -characterized by relatively high institutional trust but below-average digital confidence combined with statistically negative usability- serves as a mini-case study of administrative concentration without corresponding to user-centric performance. The nation's

administrative and technological capital does not automatically ensure a better digital service experience. Digital governance is prevented by bureaucratic complexity, congestion effects, and institutional frictions, indicative of localized conversion frictions for national AI adoption. Moreover, the alignment of trust, usability, and digital confidence in regions like Crete and Central Macedonia is relatively clear. This unequal capacity of institutions in Greek regions results in differentiated regional absorptive capacity, which means that AI diffusion in these areas, unless overcoming localized institutional bottlenecks and path dependencies, will remain regionally asymmetric.

To translate technological potential into inclusive development, policy interventions must accordingly shift from infrastructure expansion to a capacity-oriented approach. Since digital confidence is closely linked to functional performance, the government must focus on the demand-side conditions of AI by adopting user-centered design, simplifying administration, and facilitating integration between digital platforms. In regions such as Attica, policy should first focus on simplifying bureaucracy before initiating AI solutions, in a way that technology eliminates rather than automates existing inefficiencies. Furthermore, the educational gradient observed in usability and digital confidence demands digital literacy programs that go beyond a general agenda to focus on reskilling and assisted-access strategies for lower-educated groups and SMEs. Sustaining the long-term technological upgrading requires domestic knowledge capital to be strengthened. To counter brain-drain and ensure that advanced digital and AI capabilities become widespread across all regional innovation hubs, not only in a few metropolitan centers, it is necessary to encourage high-skilled ICT professionals to remain within the national innovation ecosystem.

The analysis acknowledges several shortcomings. The survey is inherently subjective, measuring perceptions and lived experiences rather than actual digital behavior or objective system performance; thus, “usability” is a measure of user satisfaction, not technical efficiency. In addition, the cross-sectional design is a diagnostic approach but fails to capture trust and confidence evolution through time, since digital services are iteratively and progressively better through time. Moreover, while the analysis comments on AI’s effects on the productive system, the analysis is non-firm-level, so the researcher does not associate citizen-user judgments with enterprise-

level AI adoption or managerial decision-making. Lastly, excluding "Don't know" responses, although necessary to ensure index consistency, risks subtle bias by not fully representing the most marginalized or digitally alienated segments of the population, especially lower-educated groups who may have a greater cognitive burden in the evaluation of complex digital governance systems.

Future studies should carry out longitudinal research to see if the performance-based nature of digital confidence is stable or if there needs to be a “trust floor” in the future for more advanced AI integrations. There is also a strong necessity for comparative studies between Greece and other Mediterranean economies to determine whether the metropolitan centralization-performance tension is an established aspect of centralized digital governance in the peripheral European context. Finally, future research should investigate how digital attitudes of the workforce affect internal absorptive capacity of SMEs, which can further bridge the gap between citizen- and firm-level dynamics. This would lead to a clear view of the cognitive and resource constraints that prohibit small businesses from translating technological access into productivity gains and, therefore, would help develop the structural conversion framework for wider use across transition economies.

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Appendix A. Construction of Composite Indices

The calculation of the three indices -presented below- is based on items from the JustReDI survey (Papadoudis et al. 2025).

A1. Institutional Trust Index (ITI)

The Institutional Trust Index is based on nine items (Q3.16a-Q3.16i), each measured on a 1-10 ordinal scale, where higher values indicate greater trust.

Respondents were asked:

“How much do you trust each of the following institutions?”

The institutions included:

Mass Media

The National Government

Regional Administration

Local Government Authorities

Non-Governmental Organizations

Businesses

Universities and Research Centers

The European Union

The United Nations

All nine items were retained without reverse coding (higher values = higher trust). The raw index (ITI_raw) was calculated as the unweighted row mean of all non-missing responses. The standardized index (ITI_z) was computed using z-score normalization across the full sample.

A2. Digital Confidence Index (DCI)

The Digital Confidence Index is constructed from three survey items:

Q4.4 - Perceived usefulness of digital services

Q4.6 - Experience with mandatory digital interactions

Q4.17 - Perceived future importance of digital technologies

The specific question wording is as follows:

Q4.4 - Usefulness of digitalization

“Do you consider the digitalization of everyday public and private services to make your life easier or more difficult?”

1 = Easier

2 = More difficult

3 = No change / Does not affect my life

99 = Don’t know / No answer

Q4.6 - Mandatory digital procedures

“Do you feel that the mandatory digitalization of certain daily procedures (e.g., banking transactions, public administration procedures) has:”

1 = Facilitated them, making them faster than before

2 = Made them more difficult than before

3 = Excluded you entirely from performing them

99 = Don’t know / No answer

Q4.17 - Future importance of digital technology

“In ten years from now, would you say that digital technology and the internet will be for your life:”

1 = Much more important

2 = Quite more important

3 = Less important

4 = Not important at all

99 = Don’t know / No answer

All “99” (Don’t know / No answer) responses were recoded as missing data prior to index construction.

Since the three items are measured on ordinal scales with different ranges (1-3 for Q4.4 and Q4.6; 1-4 for Q4.17), and due to the fact that lower numeric values reflect more positive attitudes in the original coding, each item was first reverse-coded and rescaled using min-max normalization to ensure consistent directionality (higher values = more positive digital confidence), equal weighting across items, and a common 0-1 metric.

The transformations were as follows:

For Q4.4 and Q4.6 (range 1-3):

$$r_i = \frac{3 - raw_i}{2}$$

For Q4.17 (range 1-4):

$$r_i = \frac{4 - raw_i}{3}$$

The rescaled variables generated under this procedure vary between 0 (fully negative attitude) and 1 (fully positive attitude). The computed harmonized Digital Confidence Index (DCI_raw) represents the unweighted row mean of these three rescaled items for each respondent, allowing for partial nonresponse. For comparability across composite indicators, a standardized version (DCI_z) was obtained using z-score normalization for the entire sample (mean = 0, SD = 1). Higher values indicate stronger performance-based confidence in digitalization.

A3. Digital Public Services Usability Index (DPSUI)

The Digital Public Services Usability Index captures perceived accessibility, obstacles, and quality of digital public services. It combines two types of indicators: reported barriers and evaluations of service performance.

(a) Two binary items were included:

Q4.13b - Requirements for personal digital tools (e.g., email, digital signature, identification systems)

Q4.13d - Insufficient instructions or absence of digital assistance

Original coding:

1 = Yes (obstacle present)

2 = No (obstacle absent)

These variables were reverse-coded so that:

1 = No obstacle

0 = Obstacle present

Higher values therefore indicate smoother digital interaction.

(b) Service Quality Evaluations (Q4.15a-Q4.15g)

Respondents were asked to compare digital public services with in-person services and indicate agreement with statements regarding:

Time saving

Cost saving

Speed of service

Transaction security

Environmental friendliness

Overall service quality

Adequacy in handling special cases

Original scale:

1 = Strongly agree

5 = Strongly disagree

All items were reverse-coded using the transformation:

$$revi = 6 - rawi$$

so that higher values reflect more positive evaluations.

All reversed service-quality items and obstacle indicators were combined. The raw index (DPSUI_raw) was computed as the unweighted row mean of all valid reversed items. The standardized index (DPSUI_z) was produced using z-score normalization across the full sample.

A4. Multivariate structural decomposition

The relative contribution of structural factors to digital confidence was examined by evaluating survey-weighted ordinary least squares (OLS) models, with standardized Digital Confidence Index (DCI) as the dependent variable. Independent variables include standardized Institutional Trust (ITI), standardized Digital Public Service Usability (DPSUI), educational attainment, and regional fixed effects (NUTS-2).

Table A1. Survey-Weighted OLS Regression: Determinants of Digital Confidence

Variable	Coefficient	Std. Error	t	p-value
Education (ref: Primary Incomplete)				
Primary	0.180	0.130	1.39	0.164
Lower Secondary	0.703***	0.128	5.50	0.000
Upper Secondary	1.300***	0.122	10.68	0.000
Post-Secondary Vocational	1.445***	0.123	11.73	0.000
University Degree	1.507***	0.122	12.36	0.000
Master's Degree	1.576***	0.125	12.65	0.000
Doctorate	1.555***	0.152	10.21	0.000
Institutional Trust	0.032***	0.012	2.73	0.006
Digital Public Service Usability	0.417***	0.015	28.06	0.000
Region (ref: East Macedonia & Thrace)				
Central Macedonia	-0.054	0.043	-1.27	0.206
Western Macedonia	-0.108	0.077	-1.42	0.157
Epirus	-0.051	0.074	-0.69	0.488
Thessaly	-0.042	0.054	-0.78	0.435
Ionian Islands	0.034	0.092	0.37	0.714
Western Greece	-0.023	0.055	-0.42	0.678
Central Greece	-0.201***	0.061	-3.27	0.001
Peloponnese	-0.257***	0.062	-4.17	0.000
Attica	-0.219***	0.041	-5.31	0.000
North Aegean	0.012	0.104	0.12	0.906
South Aegean	-0.144**	0.063	-2.27	0.023
Crete	-0.113**	0.054	-2.11	0.035
Constant	-1.082***	0.123	-8.78	0.000
Observations		4,961		
Population size		8,656,544		
Design df		4,960		
F-stat		175.92		
Prob>F		0.000		
R-squared		0.489		

Notes: Survey-weighted OLS estimates using population weights (Weight_2). Dependent variable: standardized Digital Confidence Index (DCI). Education reference category: Primary Incomplete. Regional reference category: East Macedonia & Thrace. Coefficients for categorical variables are interpreted relative to the reference category. ITI and DPSUI are standardized (z-scores). ***denotes statistical significance at 1% level, ** denotes statistical significance at 5% level.

Usability is the most powerful structural predictor of digital confidence. On a relative basis, a one standard deviation increase in perceived usability is positively correlated with a 0.42 standard deviation increase in digital

confidence. Educational attainment is highly significant (except for primary education), indicating a strong and monotonic human capital gradient even after controlling for usability and institutional trust.

Institutional trust has a positive but relatively small effect ($\beta = 0.032$). Although statistically significant, this effect is significantly smaller than that of usability and educational attainment.

The model accounts for about 49% of the variance of digital confidence ($R^2 = 0.490$), thus the model explains functional experience, educational stratification and regional context to explain a substantial proportion of attitudinal variation. The higher coefficient of usability relative to institutional trust reinforces the interpretation that digital confidence in Greece is more defined by performance-based experience rather than legitimacy perceptions.