


The Reskilling Paradox: Digital Government Transformation and Workforce Inertia in Post-Soviet Bureaucracies

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Abstract

Digital government transformation is reorganizing public-sector work at a pace that civil service institutions have struggled to keep pace with. This article examines whether digital upgrading in Kazakhstan and Uzbekistan has produced a meaningful restructuring of the civil service workforce and why the translation of infrastructure investment into occupational change remains incomplete. The study draws on an asymmetric comparative design, combining shift-share occupational decomposition and vacancy-platform analysis for Kazakhstan with qualitative process tracing for Uzbekistan. In Kazakhstan, routine-intensive occupational shares declined over 2018-2024, yet persistent gaps in digital skill requirements and post-hire training suggest that formal restructuring has outpaced actual capability development. Uzbekistan shows a sharper version of the same pattern, where major digital and AI initiatives were launched before any consolidated reskilling architecture existed for the civil service core. These findings are captured through the concept of the reskilling paradox. Centralized personnel control, hierarchical information flows, and compliance-oriented organizational cultures act as friction coefficients that slow workforce adaptation regardless of how far digital platforms have advanced. Digital modernization, the evidence suggests, cannot be assessed solely through infrastructure.

Keywords: Digital government; public administration; occupational restructuring; institutional frictions; reskilling paradox; civil service; digital skills; post-Soviet states; Kazakhstan; Uzbekistan

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1. Introduction

Governments worldwide are reorganizing around digital infrastructure. While this shift has generated a massive body of reform literature, there is surprisingly little scrutiny regarding what actually happens within the bureaucracy itself (Dunleavy & Margetts, 2023; Mergel et al., 2023). A growing literature maps the spread of e-government platforms, AI tools, and digitally enabled service delivery, but much less is known about how these changes alter the occupational structure of government itself (van Noordt & Misuraca, 2022; Madan & Ashok, 2023). This gap is especially important in transitional administrative systems, where public employment simultaneously performs administrative, social, and political functions.

In Kazakhstan and Uzbekistan, investment in digital government infrastructure and AI-related reforms has accelerated administrative digitalization in recent years (Kuldosheva, 2021). Both countries have expanded online services, digital identity tools, and broader state modernization

agendas to strengthen governance capacity through technology (Keegan, 2023). This raises a central issue for the present study: whether digital upgrading reduces routine administrative work while increasing demand for analytical and digital skills within the civil service (Autor et al., 2003; Bilan et al., 2023).

The relationship between technological change and employment is commonly interpreted through the routine-biased technological change framework, which predicts that digital technologies substitute for routine cognitive tasks while complementing non-routine analytical and interpersonal work (Autor et al., 2003; Goos et al., 2014). Yet most supporting evidence comes from private labor markets in advanced economies rather than from bureaucratic settings (Autor & Dorn, 2013; Acemoglu & Autor, 2011). Public administrations are different because employment is embedded in legal mandates, hierarchical personnel systems, and political accountability arrangements that can slow or redirect adjustment (Webb, 2020; Cordella & Gualdi, 2025).

The study focuses on whether the expansion of digital government has truly changed the composition of civil service jobs in Kazakhstan and Uzbekistan, and on the specific mechanisms driving those shifts. The analysis connects digital maturity trajectories to routine-task exposure within bureaucratic employment, a link the literature has assumed but rarely tested in non-OECD settings. Kazakhstan serves as the anchor case because occupation-level administrative data allow tracing changes in employment by routine intensity, while Uzbekistan serves as a contrast case in which the same mechanism must be pursued through institutional reforms and policy implementation with weaker data availability (Mussagulova, 2021).

The article engages the existing literature on three fronts: it brings the routine-biased technological change perspective into contact with post-Soviet public administration, proposes the reskilling paradox as a mid-range concept for this setting, and tests whether an asymmetric comparative design can do analytical work where microdata are uneven.

The question is not purely academic. Kazakhstan employs approximately 83,009 civil servants across its administrative apparatus, out of 90,583 authorized positions as of January 1, 2024, indicating an 8.4 percent vacancy rate (Bureau of National Statistics of Kazakhstan, 2024). For Uzbekistan, two analytical levels of public employment are distinguished: the civil-service core (public administration and defense) and the broader state sector, including state-owned enterprises and publicly provided services. In 2024, the civil-service core employed 634.9 thousand persons, while total state-sector employment reached 2.6 million (National Statistics Committee of the Republic of Uzbekistan, 2024). Throughout the paper, the occupational analysis and all references to “civil service” correspond to the civil-service core, while the broader state-sector employment series is used only to contextualize the scale of public employment in the economy (Bureau of National Statistics of Kazakhstan, 2024; National Statistics Committee of the Republic of Uzbekistan, 2024).

This broader category matters because a large share of public employment is concentrated in tasks such as document processing, data entry, compliance verification, and standardized citizen service delivery, which are especially exposed to automation (Autor et al., 2003; Frey & Osborne, 2017). Task-based research also suggests that automation should be evaluated at the level of task bundles rather than at the level of whole occupations, which is particularly relevant for administrative work that mixes routine and non-routine elements (Acemoglu & Restrepo, 2019; Tolan et al., 2021). At the same time, the political economy of bureaucratic employment in Central Asia differs from the OECD settings that dominate the automation literature, because civil-service positions retain social prestige, income stability, and patronage value alongside their administrative role.

2. Literature Review and Theoretical Framework

AI implementation in public administration is increasingly framed as a workforce and organizational transformation challenge rather than a narrow service-delivery upgrade (Mergel et al., 2023), yet the empirical literature still tilts toward algorithmic decision-making and service-delivery outcomes over employment restructuring (Madan & Ashok, 2023). Evidence from comparative mappings shows that adoption is uneven across functions and jurisdictions, with concentrations in back-office domains such as document classification, fraud detection, and scheduling, which closely overlap with routine cognitive tasks highlighted in task-based accounts of computerization risk (Van Noordt & Misuraca, 2022; Autor et al., 2003).

At the same time, the organizational consequences extend beyond task substitution: research on “algorithmic bureaucracy” and street-level discretion suggests that automation can reshape power relations and discretion, sometimes reinforcing existing biases rather than removing them (Vogl et al., 2020; de Boer and Raaphorst, 2023).

A parallel governance strand emphasizes decision-level risks such as automation bias and selective adherence, and it questions whether conventional accountability architectures remain adequate as consequential choices are increasingly mediated by automated systems (Alon-Barkat & Busuioc, 2023; Busuioc, 2021; Wirtz et al., 2020). Recent conceptual work goes further by treating AI as a structural force that formalizes procedures and accelerates a new wave of digital-era governance, extending longer trajectories of bureaucratic rationalization (Cordella & Gualdi, 2025; Dunleavy & Margetts, 2023; Levy et al., 2021).

The canonical RBTC framework, developed by Autor et al. (2003) and extended by Goos et al. (2014), holds that technological change disproportionately displaces workers performing cognitive and manual tasks that can be codified and automated, while complementing workers performing non-routine abstract and interpersonal tasks. The framework predicts labor market polarization, with growth concentrated at the top and bottom of the skill distribution and hollowing out in the middle. Empirical support for this pattern has been found across multiple OECD countries and time periods (Autor & Dorn, 2013; Acemoglu & Autor, 2011).

While RBTC was formulated primarily to explain private-sector adjustment under competitive pressure, public-sector task structures differ in ways that can bend the trajectory it predicts. In government, routine tasks are often embedded in legally mandated procedures and evidentiary requirements, so automation tends to redesign compliance workflows rather than simply replace labor. Adjustment is also slower because performance incentives and competitive pressures are weaker than in private markets. Even where automation is technically feasible, accountability requirements and the need to preserve human discretion continue to limit the scope of displacement (Webb, 2020; OECD Employment Outlook, 2023).

Yet the framework has never been fully at home in public-sector settings. Haslberger (2021) shows that RBTC does not consistently produce polarization across 10 OECD countries between 1995 and 2013, with institutional factors, such as collective bargaining coverage, mediating the employment response. The extension of automation to non-routine cognitive tasks through advanced AI has further complicated the picture: Georgieff & Hye (2022) use novel cross-country data to show that AI exposure is now spreading into high-skill occupational categories that were previously considered safe, and Eloundou et al. (2023) estimate that large language models could affect a substantial fraction of occupational tasks across the skill distribution. Panel evidence across 63 countries similarly shows that higher AI vibrancy is associated with declining

unemployment in high-skill service occupations but rising structural displacement in routine-intensive employment categories, reinforcing the heterogeneity of AI-driven adjustment across skill groups (Kuzior et al., 2025). Frey & Osborne (2017) estimated that 47 percent of US jobs face high automation risk within a decade or two, though subsequent work by Tolan et al. (2021), using a task-level rather than occupation-level methodology, produced lower and more differentiated estimates.

The application of RBTC to public sector employment presents additional complications. First, government jobs are less subject to the competitive market forces that drive private-sector automation. Second, many public sector "routine" tasks are embedded in legal mandates that constrain the pace of automation. Third, public employment carries social functions, including income support in depressed regions and political patronage, which means headcount decisions are made on grounds other than productivity. Webb (2020) estimates that AI will expose a much larger share of higher-wage knowledge work than earlier waves of automation, suggesting that civil service occupations previously thought to be immune may now face significant displacement pressure. The OECD Employment Outlook (2023) finds that high-skill occupations carry the lowest aggregate risk of automation, but notes that specific tasks within those occupations, including data analysis, report writing, and compliance review, are increasingly within the technical reach of current AI systems.

Neo-institutional theory provides the second pillar of our analytical framework. North (1990) defines institutions as the rules of the game in a society, both formal (laws, regulations) and informal (norms, conventions), and emphasizes that these rules constrain the menu of choices available to organizations. DiMaggio & Powell (1983) identify isomorphic pressures that push organizations in the same field toward similar structures, while Mahoney (2000) and Pierson (2000) develop the concept of path dependence to explain why early institutional choices generate self-reinforcing mechanisms that make deviation costly even when circumstances change. These theoretical tools have been applied to post-Soviet administrative development by a growing body of scholars.

Mussagulova (2021) demonstrates that Soviet administrative inheritance shapes innovation trajectories in post-Soviet states through three channels: centralized decision-making authority, risk-averse organizational cultures, and the subordination of technical expertise to political loyalty. Kazakhstan and Uzbekistan illustrate this dynamic differently. Rather than a simple contrast between reform and stagnation, they represent two distinct varieties of managed inertia. These features are documented across multiple successor states, though their intensity varies. Recent empirical evidence from Uzbekistan also indicates that institutional efficiency and human capital capacity are critical determinants of performance outcomes in transitional public institutions (Tagaev et al., 2025). Kazakhstan presents a case of managed institutional hybridization, in which Soviet administrative forms have been gradually overlaid with New Public Management-inspired reforms, creating a layered institutional architecture (Knox & Orazgaliyev, 2025; Kassen, 2016). Uzbekistan under Mirziyoyev, by contrast, has pursued a more abrupt modernization campaign, using the shock of top-down decrees to overcome the inertia that Mussagulova (2021) and Bertelsmann Stiftung (2024) identify as the default trajectory of post-Soviet bureaucracies.

Digital transformation in Central Asia has been examined from multiple angles. Kuldosheva (2021) identifies three persistent barriers to public-sector digitalization in Uzbekistan: weak data infrastructure, low public trust in digital services, and a shortage of IT-capable civil servants. These barriers are also well-documented in Kazakhstan (Sabdenov et al., 2025; Sergaliyeva et al., 2022). Keegan (2023) adds a political economy dimension, arguing that digital

authoritarianism in Central Asia creates a distinctive incentive structure in which governments adopt e-government to enhance surveillance and control rather than to improve service quality. This complicates the relationship between EGDI scores and genuine administrative modernization. Emerging research also shows that the digitalization of labor markets is reshaping migration patterns: remote work technologies are enabling highly skilled workers from Kazakhstan, Uzbekistan, and neighboring countries to integrate into external labor markets without physical relocation, creating new forms of talent competition for public-sector employers (Tutar & Bilan, 2026).

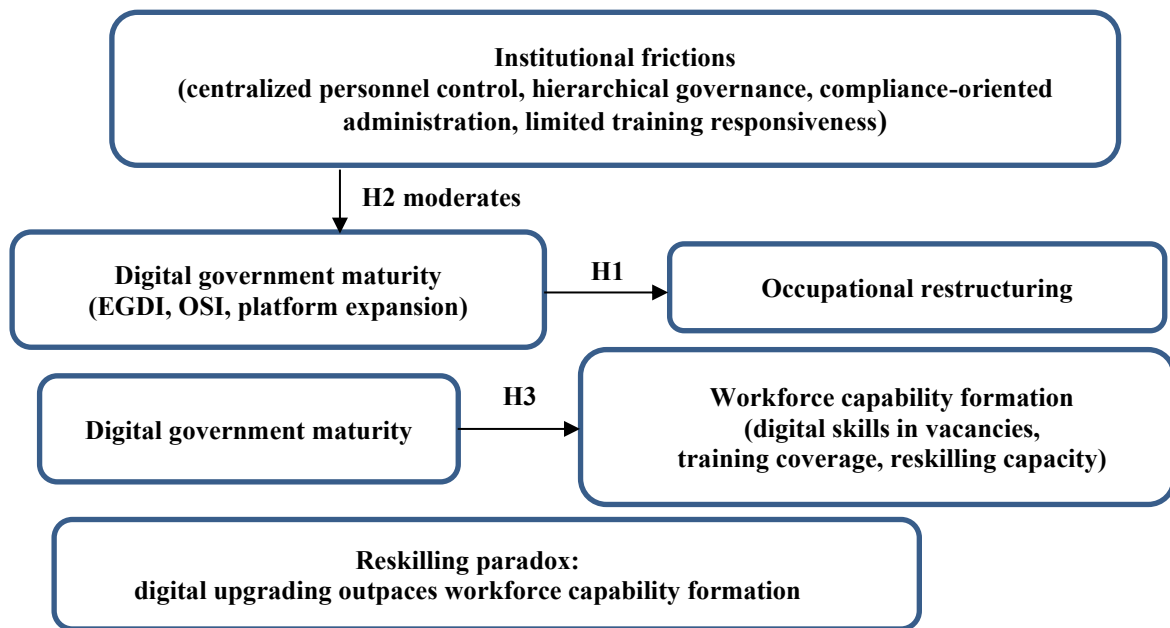
The interaction between digital transformation and employment in the region has received remarkably little direct attention. Nurgali & Djumabayev (2025) analyze how digitalization tools are used to evaluate civil servants in Kazakhstan and find that performance measurement systems remain largely paper-based, while digital evaluation tools are adopted selectively to reinforce rather than transform existing hierarchies. Iskendirova et al. (2024) document the slow diffusion of digital competency training in the Akmola region and attribute the gap to a mismatch between nationally designed training curricula and locally available instructional capacity. These findings point toward a reskilling paradox that the study explores at a national comparative scale. The gap, in short, is not incidental. The concept differs from three adjacent constructs. Skills mismatch denotes individual-level qualification gaps (OECD, 2023); capability gap captures a static skill deficit; and technology-skills gap describes economy-wide human capital lags behind technological adoption (Pauceanu et al., 2020). At the organizational level, the reskilling paradox centers on the tension between rapid infrastructure expansion and the slower pace of professional capability development. This concept identifies the specific institutional mechanisms within public bureaucracies that drive this structural imbalance (Habánik et al., 2021; Jurczuk & Florea, 2022). The operationalization of the core mechanisms and their observable proxies is summarized in Figure 1.

H1. In the Kazakhstan anchor case, higher digital maturity is associated with a relative decline in routine-intensive occupational functions and a compositional shift toward lower-routine positions within the civil-service core. In Uzbekistan, the same mechanism is assessed indirectly through reform sequencing and institutional evidence rather than direct occupational microdata.

H2. The translation of digital upgrading into workforce restructuring is weaker where institutional frictions remain more binding, especially under centralized personnel control, hierarchical administrative coordination, and compliance-oriented management. This expectation is evaluated primarily through structured cross-case comparison rather than symmetric statistical testing.

H3. Across both cases, digital expansion is expected to outpace the formation of workforce capabilities, creating a reskilling paradox in which infrastructure, platforms, and formal digital strategies outpace the institutional mechanisms needed to recruit, train, and redeploy civil servants.

Figure 1. Conceptual framework linking digital government maturity, occupational restructuring, institutional frictions, and workforce capability formation



Note: H1 captures the expected association between digital government maturity and occupational restructuring. H2 indicates the moderating role of institutional frictions. H3 refers to the expected imbalance in which digital upgrading outpaces the development of workforce capabilities, producing the reskilling paradox.

3. Data and Methodology

This study adopts an asymmetric comparative design within a most-similar-systems framework. Kazakhstan and Uzbekistan share a post-Soviet administrative legacy, centralized executive structures, and state-led digitalization agendas, but differ in reform sequencing, personnel governance, and the transparency of workforce data. Kazakhstan is treated as the quantitative anchor case because occupation-level and vacancy-based evidence permit a direct assessment of changes in routine intensity and workforce capability gaps within the civil-service core. Uzbekistan is analyzed as a theory-elaborating contrast case in which the same mechanisms are traced through reform sequencing, institutional design, and programmatic evidence under more limited data conditions. The comparison is not intended to impose identical measurements on both countries. Its purpose is to examine whether the same underlying mechanism can be observed through different forms of evidence.

Six primary data sources are combined to construct a harmonized evidence base for Kazakhstan and Uzbekistan. In this analysis, we adhere to strict terminological distinctions. The term “core civil service” encompasses administrative employment in the public administration and defense sectors. Meanwhile, the term “public sector employment” refers to a broader aggregate indicator that includes state-owned enterprises and the public services sector. Administrative employment statistics provide the occupation-by-sector structure for the descriptive decomposition, while international digital-government indicators (the UN Department of Economic and Social Affairs' EGDI and its subcomponents) capture cross-country trajectories of digital maturity. To characterize the institutional environment in which digitalization translates into workforce

adjustment, we draw on official civil-service regulations and reform documentation, including the design features of HR and e-government systems used for recruitment, personnel management, and compliance reporting.

Table 1B supplements the qualitative evidence with selected governance indicators (WGI and WJP) used as indirect ordinal proxies for the institutional environment. The World Bank (2024) provides annual percentile-ranked scores on Government Effectiveness, Rule of Law, and Control of Corruption for both Kazakhstan and Uzbekistan from 2018 to 2023 (World Bank, 2024). These are read together with the WJP Rule of Law Index Factor 1 as indirect contextual indicators of the broader governance environment. In this study, these indicators are used for broad cross-case comparison over time rather than as direct measures of specific institutional frictions. The indicators suggest that governance constraints remain more binding in Uzbekistan than in Kazakhstan, but this interpretation is contextual rather than strictly identificatory.

Vacancy-platform signals are used as directional triangulation for skills demand rather than as a census measure. Together, these sources allow us to link changes in digital capacity to patterns of occupational restructuring and to operationalize institutional frictions as observable governance and HR features, summarized in Table 1A.

Table 1A. Qualitative Institutional Proxies

| Dimension of institutional friction | Kazakhstan (proxy) | Uzbekistan (proxy) | Source |
|-------------------------------------|---|--|--|
| Centralized personnel control | Civil service recruitment is centralized through the e-Qyzmet system and the Agency for Civil Service Affairs | Recruitment and HR management are coordinated through ARGOS and centralized state personnel procedures | ACSA; ARGOS documentation |
| Hierarchical decision-making | Formal hierarchical approval chains in ministerial staffing and promotion processes | Vertical administrative reporting structures within ministries and regional administrations | National civil service regulations |
| Compliance-oriented management | Performance evaluation systems focused on procedural compliance and reporting | Administrative evaluation practices emphasizing rule compliance and formal accountability | Government administrative reform reports |
| Limited training responsiveness | Training programs are coordinated centrally, with a limited link to occupational restructuring | Training programs are largely standardized and not directly linked to digital capability needs | Government training program reports |

The two cases are analyzed through deliberately asymmetric methods. For Kazakhstan, the empirical strategy combines quantitative shift–share decomposition of occupational structure with vacancy-platform signals and survey-based skills-gap indicators. For Uzbekistan, the analysis applies qualitative process tracing, drawing on reform documentation, administrative program design, and the observable sequencing of infrastructure versus training investments. This asymmetric nested design follows the logic of Gerring (2007), in which a quantitative anchor case is paired with a qualitative contrasting case to extend theoretical inference beyond the conditions under which microdata are available. Together, these sources allow the study to link digital maturity trajectories, occupational restructuring, institutional frictions, and workforce capability signals within a single comparative framework.

To provide contextual ordinal support for the cross-case comparison, Table 1B reports selected published governance indicators that are used as indirect proxies for the institutional environment rather than as direct measures of each friction dimension.

Table 1 B. Contextual Governance Indicators Used as Indirect Ordinal Proxies (2018, 2023)

| Institutional friction dimension | Index (source) | Kazakhstan 2018 | Kazakhstan 2023 | Uzbekistan 2018 | Uzbekistan 2023 |
|--|---|-----------------|-----------------|-----------------|-----------------|
| Personnel governance context | WGI: Control of Corruption (percentile) | 37.1 | 38.5 | 14.9 | 23.1 |
| Decision-making constraints context | WJP Factor 1: Constraints on Gov't Powers (0–1) | 0.37 | 0.40 | 0.26 | 0.34 |
| Legal-administrative compliance context | WGI: Rule of Law (percentile) | 44.7 | 46.2 | 16.3 | 28.4 |
| Administrative capability and adaptation context | WGI: Government Effectiveness (percentile) | 52.4 | 57.1 | 21.2 | 34.6 |

Sources: World Bank (2024). Worldwide Governance Indicators. <https://www.govindicators.org>. World Justice Project (2024). WJP Rule of Law Index 2024. All WGI values are percentile ranks (0 = lowest, 100 = highest). WJP scores are on a 0–1 scale. Higher scores indicate more favorable governance conditions in the underlying source indices. In this article, these values are used only as indirect ordinal proxies for the broader institutional environment and should not be interpreted as direct one-to-one measures of the friction dimensions listed in the table. The pattern nevertheless suggests that governance constraints remain present in both cases and are comparatively more binding in Uzbekistan than in Kazakhstan.

The empirical design uses two complementary time windows. Indicators of digital maturity (EGDI and related infrastructure measures) are reported for the full 2014–2024 period to provide a long-run institutional and technological background. However, the core occupational restructuring analysis focuses on the 2018–2024 interval, which reflects the period for which consistent occupational employment structures in the public sector are available and comparable across Kazakhstan and Uzbekistan. The earlier years are therefore used for contextual dynamics and robustness checks rather than for the main shift–share decomposition.

Table 2. UNDESA E-Government Indicators and OSI, 2014–2024, waves

| Wave year | Uzbekistan | | Kazakhstan | |
|-----------|------------|--------|------------|--------|
| | EGDI | OSI | EGDI | OSI |
| 2014 | 0.4695 | 0.4488 | 0.7283 | 0.7165 |
| 2016 | 0.5434 | 0.4348 | 0.7250 | 0.6522 |
| 2018 | 0.6207 | 0.7396 | 0.7597 | 0.8681 |
| 2020 | 0.6665 | 0.6884 | 0.8375 | 0.8836 |
| 2022 | 0.7265 | 0.7440 | 0.8628 | 0.9344 |
| 2024 | 0.7999 | 0.7648 | 0.9009 | 0.9390 |

Source: UNDESA, United Nations E-Government Survey (2014, 2016, 2018, 2020, 2022, 2024). EGDI is the composite index of online services, telecommunications infrastructure, and human capital; OSI reflects the online service component and serves as the closest proxy for digital government service maturity.

All indicators used in the analysis are derived from publicly available administrative statistics, international datasets, or previously published empirical studies. Occupational classifications follow the ISCO-08 structure linked to routine-task measures derived from the O*NET task framework. Vacancy evidence for Kazakhstan is based on postings published on the mandatory civil service platform e-qyzmet.kz. A summary of variables, sources, and measurement definitions is provided in the Data Appendix.

We analyze changes in the employment structure of the civil-service core using an accounting identity and a modified shift–share decomposition. Occupations are classified by routine intensity using an ISCO-08/O*NET concordance and then grouped into high-, medium-, and low-routine categories. The empirical focus is on changes in the employment shares of these routine-intensity groups between the base and terminal year rather than on a continuous occupation-level routine index.

Using this accounting framework, the change in each group’s employment share is decomposed into a scale component and a composition component. The scale component captures the overall employment adjustment, while the composition component captures reallocation across routine-intensity groups within the civil-service core. Because the data are based on administrative headcounts rather than survey estimates, the decomposition is used descriptively. It helps identify the direction and relative scale of employment reallocation, but it is not intended to support causal claims.

For Kazakhstan, where disaggregated occupational data are available, this decomposition provides descriptive evidence on whether digital upgrading coincides with a decline in the employment share of high-routine positions and a corresponding reallocation toward lower-routine functions within the civil-service core. Given that the base and terminal observations are not fully comparable in level terms, the decomposition is used to identify directional changes in occupational structure rather than to claim a definitive test of H1. For Uzbekistan, where comparable occupational microdata are not systematically published, the same mechanism is examined through reform sequencing, institutional design, and programmatic evidence on workforce adjustment and training capacity.

4. Results

Kazakhstan and Uzbekistan occupy different positions on the digital maturity curve, but the gap between them has narrowed sharply since 2020. «Kazakhstan's progress has been consistent. The country has demonstrated steady growth in the EGDI ranking, rising from 29th to 24th place. The country scored in the global top 10 on the Online Service Index in 2024, alongside the Republic of Korea, Denmark, and Estonia (UN DESA, 2024). By the end of 2024, 92 percent of public services were delivered electronically, up from approximately 80 percent in 2020. Kazakhstan was ranked first among landlocked developing countries, with an EGDI score of 0.9009 (UN DESA, 2024; World Bank, 2023). These digital maturity indicators are reported in Table 2 and provide a descriptive baseline for interpreting subsequent employment restructuring and routine exposure patterns.

Uzbekistan's trajectory is considerably steeper. The country gained 24 positions in the EGDI between 2020 and 2024, moving from the “High” to the “Very High” group. More than 675 public services were made available through the My.gov.uz portal by October 2024, and the number of internet users reached 31 million out of a population of approximately 38 million

(OECD, 2024b). The “Digital Uzbekistan 2030” strategy, launched in 2020 and significantly accelerated by the AI Strategy approved through Presidential Resolution RP-358 in October 2024, provides the programmatic framework for this transformation (Regulations AI, 2024; OECD, 2024b). The strategy sets targets to place Uzbekistan among the top 50 countries in the Government AI Readiness Index, generate 1.5 billion dollars in AI-based services by 2030, and ensure that at least 10 percent of public services on the unified portal are powered by AI.

The two countries' civil service systems share a common institutional heritage but have evolved differently since independence. According to data from the Bureau of National Statistics of Kazakhstan, 9.2 million people were employed across the economy in 2024, of whom 7 million were employees and 2.2 million were self-employed (Bureau of National Statistics of Kazakhstan, 2024). Within this broad employment landscape, civil service positions constitute a relatively small yet symbolically significant segment: 90,583 authorized posts, of which 83,009 were filled as of January 1, 2024, leaving an estimated vacancy rate of 8.4 percent (Agency of the Republic of Kazakhstan for Civil Service Affairs, 2024). For Uzbekistan, we track the civil service core separately within the public administration and defense sectors. In 2024, this segment employed 634.9 thousand persons, a figure that is analytically distinct from the broader state-sector employment category. Civil-service dynamics are interpreted as administrative restructuring rather than a direct proxy for the scale of state ownership in the economy.

The decomposition indicates a directional decline in the share of high-routine employment and a corresponding increase in the share of low-routine occupations within Kazakhstan’s civil-service core (see Table 3). Of the 7-percentage-point decline in the high-routine share, 5 points are attributable to composition and 2 to scale, while the low-routine share increases by 9 percentage points, of which 8 are attributable to composition. They point to a possible reallocation away from routine-intensive administrative functions, but they do not, by themselves, establish the magnitude of that restructuring with full precision.

Table 3. Directional change in the occupational structure of Kazakhstan’s civil-service core by routine intensity, 2018–2024

| Routine intensity group | Example ISCO groups | Employment share 2018 (%) | Employment share 2024 (%) | Change (pp) |
|-------------------------|---|---------------------------|---------------------------|-------------|
| High-routine | Clerical support, data entry | 34 | 27 | -7 |
| Medium-routine | Technicians, administrative specialists | 41 | 39 | -2 |
| Low-routine | Managers, professionals | 25 | 34 | +9 |
| Total | | 100 | 100 | 0 |

Source: Authors’ calculations based on occupational employment data from the Agency for Civil Service Affairs of Kazakhstan (ACSA, 2018; 2024), classified by routine intensity using the ISCO-08/O*NET concordance following Autor, Levy, and Murnane (2003).

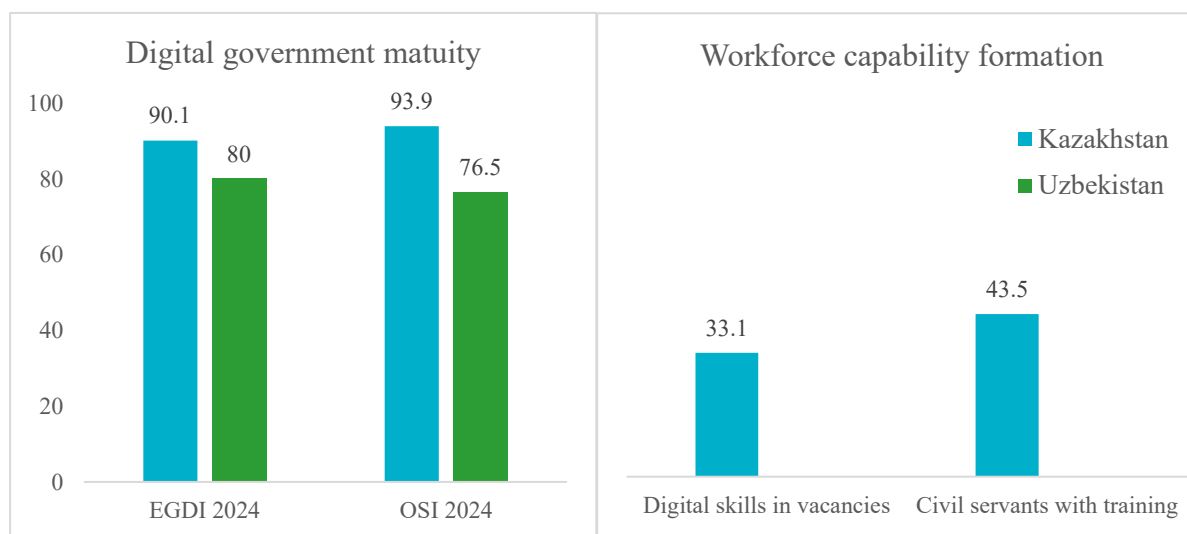
Note: 2018 values are based on authorized headcount, whereas 2024 values are based on filled positions. For this reason, the table reports only employment shares and percentage-point changes, which are used as directional indicators of structural change rather than exact measures of employment reallocation.

The following analysis draws on quantitative indicators available for Kazakhstan. The primary quantitative signals are drawn from Sabdenov et al. (2025), whose study combines vacancy-platform analysis with a survey of civil servants. These figures are treated as directional indicators rather than population estimates, and are interpreted in conjunction with the independent findings of Sergaliyeva et al. (2022) and cross-national evidence from OECD

(2023). The convergence across sources with different methodologies and samples reduces the risk of single-source bias. Uzbekistan is addressed later through qualitative evidence.

The imbalance between the expansion of digital infrastructure and the development of workforce capabilities can be illustrated visually. Figure 2 compares digital-government maturity indicators with observable signals of workforce capability development. Kazakhstan demonstrates very high digital maturity according to UNDESA indicators, yet signals of capability formation remain substantially weaker. This divergence reflects the empirical pattern identified in the present study as the reskilling paradox.

Figure 2. Digital government maturity and workforce capability signals in Kazakhstan and Uzbekistan



Note: Digital government maturity is proxied by the 2024 UN E-Government Development Index and Online Service Index. Workforce capability signals are based on vacancy- and training-based indicators for Kazakhstan, while comparable micro-level labor-market data for Uzbekistan are limited; capability values should therefore be interpreted as indicative. The figure illustrates directional patterns rather than symmetric cross-country measurement.

As Figure 2 shows, the gap between digital maturity and workforce capability formation is substantial. Kazakhstan's EGDI and OSI values are among the highest in the region, indicating advanced digital-government infrastructure and online service delivery. However, recruitment and training indicators suggest that the integration of digital competencies into civil-service workforce development remains limited. The coexistence of high digital maturity with weaker signals of capability formation provides visual support for the argument developed in H3.

The main finding is that advances in digital government are not matched by equivalent progress in workforce capability formation. This gap is consistent with broader evidence that the effectiveness of digital government reforms depends heavily on civil servants' digital competencies, which determine their capacity to interact with digital platforms and provide services in an e-society (Bilan et al., 2023). A study of 408 job postings on Kazakhstan's e-qyzmet.kz platform, combined with a survey of 200 Corps B civil servants, found that 66.9 percent of government job postings do not specify digital skills as a requirement. We address this limitation by using the figures as supporting evidence for triangulation instead of relying on them as definitive, standalone statistics. Among surveyed civil servants, 60 percent reported that digital competencies were not mandatory for their employment, and 56.5 percent had never received any formal digital skills training after being hired.

Sergaliyeva et al. (2022) observe that training budgets in Kazakhstani ministries are concentrated within a few flagship agencies, leaving most civil servants without systematic upskilling. This imbalance is structurally consistent with the vacancy-based signals identified by Sabdenov et al. (2025). The convergence of two independently conducted studies using different methodologies strengthens confidence in the skills-gap finding beyond what either source alone could support. This finding is also consistent with cross-national evidence from the OECD Employment Outlook (2023). The report highlights persistent gaps between investment in digital infrastructure and the development of civil service capabilities across transition economies. This suggests that the pattern seen in Kazakhstan is a broader structural trend rather than a unique country-specific anomaly.

Table 4 consolidates the empirical evidence for H3 by distinguishing between indicators of digital expansion and indicators of workforce capability formation. The comparison is intentionally limited to observable and defensible signals that are either directly measured or explicitly documented in official sources. Across both cases, the pattern is the same: digital government capacity expands faster than the institutional mechanisms that train, retrain, and align civil servants with new task requirements. In Kazakhstan, this imbalance is directly visible in vacancy and survey evidence. In Uzbekistan, this is reflected in the sequencing of reforms, where major digital and AI initiatives advanced ahead of a consolidated reskilling architecture for the civil service core.

Table 4. Digital expansion versus workforce capability formation in Kazakhstan and Uzbekistan, 2018–2024

| Indicator | Kazakhstan | Uzbekistan |
|---|---|---|
| EGDI, 2024 | 0.9009 | 0.7999 |
| OSI, 2024 | 0.9390 | 0.7648 |
| Civil-service core, latest available year | 83,009 filled posts (2024) | 634.9 thousand persons (2024) |
| Evidence of major digital expansion | National e-government platform expansion and administrative digitalization across the civil service | Rapid expansion under Digital Uzbekistan 2030 and AI strategy implementation, including RP-358 (2024) |
| Share of vacancies not specifying digital skills | 66.9% | No comparable vacancy microdata published |
| Share of civil servants reporting no post-hire digital training | 56.5% | No comparable training-coverage data has been published |
| Evidence on training-system alignment | Training budgets concentrated in flagship agencies; uneven access to upskilling | No consolidated civil-service reskilling envelope; digital skills governance remains fragmented across institutions |
| Overall interpretation for H3 | Direct evidence of a capability gap despite high digital maturity | Institutional evidence that reform and infrastructure advanced ahead of a consolidated reskilling architecture |

Source: Authors' compilation based on UNDESA (2024); Agency of the Republic of Kazakhstan for Civil Service Affairs (2024); Bureau of National Statistics of Kazakhstan (2024); Sabdenov et al. (2025); Sergaliyeva et al. (2022); Presidential Resolution RP-358 (2024).

Note: The table prioritizes directly interpretable indicators and removes non-equivalent derived metrics. For Kazakhstan, vacancy-platform and survey evidence provide observable signals of capability formation. For Uzbekistan, comparable vacancy- and training-coverage microdata are not systematically published, so inference relies on documented reform sequencing, digital program architecture, and the absence of a consolidated civil-

service reskilling framework. The table is therefore used to compare the structure of the imbalance underlying H3, not to claim that the measurement density is identical across both cases.

Table 4 supports H3 by showing that digital expansion outpaces the formation of workforce capabilities in both cases. In Kazakhstan, the imbalance is directly observable in recruitment and training indicators. In Uzbekistan, it is reflected in reform sequencing, where digital and AI expansion advanced faster than the development of a consolidated reskilling system.

Overall, the results indicate that progress in digital government is not matched by equivalent advances in workforce capability development. In Kazakhstan, this imbalance is evident in vacancy, survey, and occupational structure signals. In Uzbekistan, it appears in the sequencing of reforms and the absence of comparable capability-building indicators. These empirical patterns provide the basis for the interpretation developed in the Discussion section.

5. Discussion

Our findings are broadly consistent with the mechanism proposed in H1, although the strength and form of the evidence differ across the two cases. In Kazakhstan, the available decomposition points to a possible decline in the share of high-routine positions, but the result remains descriptive because the 2018 and 2024 observations are not fully comparable at the level. In Uzbekistan, the argument rests on qualitative process evidence rather than directly comparable occupational microdata. In standard RBTC models, technological change steadily erodes routine occupations while boosting demand for non-routine skills (Autor & Dorn, 2013; Goos et al., 2014). In the two cases studied here, this adjustment is better understood as a discontinuous, politically mediated pattern of restructuring rather than a smooth market-driven process.

The results also indicate that the same broad relationship between digital upgrading and workforce adjustment is evident across empirical channels in both cases. In Kazakhstan, the observed pattern is one of gradual structural adaptation, visible in directional changes in routine-intensity shares and in persistent capability gaps identified through vacancy and survey evidence. In Uzbekistan, by contrast, the same relationship is expressed through reform sequencing, institutional design, and politically authorized administrative restructuring rather than directly comparable occupational microdata. This asymmetry is analytically important because it suggests that the mechanism is shared, while its empirical manifestation remains institutionally specific.

Cross-case comparison suggests that the association between digital maturity and occupational restructuring is weaker where institutional frictions remain more binding. In both cases, centralized personnel control, hierarchical approval chains, and compliance-oriented management appear to slow the translation of digital capabilities into workforce reallocation. The evidence, therefore, supports H2 at the level of structured comparison rather than causal identification.

The Uzbekistani case further clarifies why the reskilling paradox should not be understood as a uniform process. Because disaggregated occupational microdata are not systematically published, restructuring cannot be assessed using a shift–share decomposition comparable to that in the Kazakhstani case. Instead, the evidence points to a different adjustment mechanism, in which administrative change occurs less through gradual compositional drift and more through politically authorized shocks embedded in a centralized reform process.

Several observable features support this interpretation. The 2023 reduction in civil service headcount was implemented as a top-down political decision framed in the language of efficiency rather than as a lagged consequence of completed automation. At the same time, major digital and AI initiatives advanced ahead of the consolidation of a reskilling architecture for the civil service core. The centralization of HR governance through ARGOS, combined with the institutional separation between digital infrastructure policy and civil service capability formation, further reinforced this decoupling. In that sense, the Uzbekistani case does not contradict the reskilling paradox. It reveals a sharper and more politically mediated variant of it.

The asymmetric design of this study reveals that the reskilling paradox is not a single uniform phenomenon but takes institutionally specific forms. In Kazakhstan, where quantitative decomposition is possible, it appears as measurable compositional drift away from high-routine occupations alongside persistent vacancy-based skills gaps. In Uzbekistan, where the analysis relies on qualitative process tracing, it manifests as politically accelerated restructuring that precedes rather than follows capability formation. This divergence suggests that post-Soviet bureaucracies often display a discontinuous, politically mediated pattern of adjustment, although its empirical signature varies across reform models and data infrastructures.

In the Uzbekistani case, the 2023 headcount reduction appears to have taken the form of a politically driven administrative shock rather than a gradual employment adjustment following the completion of automation. This pattern is consistent with a broader body of research showing that technological change does not simply eliminate jobs, but reorganizes task structures and creates transitional adjustment pressures that institutions do not always absorb smoothly (Brynjolfsson et al., 2018; Acemoglu & Restrepo, 2020). The case of Uzbekistan is consistent with this interpretation, as the country's workforce reductions occurred even before the AI systems designed to replace laid-off employees were fully operational.

In Kazakhstan, the pattern is actually reversed. While AI and digital infrastructure indicators rose significantly during the observation period, headcount trends did not show a matching decline. This suggests that digital upgrades do not automatically lead to a smaller workforce; instead, the data points toward institutional rigidity as the primary factor. This reflects both the social protection function of civil service employment and the institutional rigidities documented by Knox & Orazgaliyev (2025) and Kassen (2016). As a result, a workforce is formed that formally retains its positions even as digital systems increasingly automate functions previously performed manually, a pattern consistent with what Vogl et al. (2020) term residual bureaucracy. This refers to the set of tasks that remain for humans after artificial intelligence systems take over all algorithmic processes. Managing residual bureaucracy effectively requires higher-order skills in quality control, exception handling, and human-AI collaboration, precisely the skills that the current reskilling deficit prevents most Kazakhstani civil servants from developing.

The combined quantitative and qualitative evidence is broadly consistent with H2. Three institutional features characteristic of post-Soviet bureaucracies act as friction coefficients on the RBTC mechanism.

The first is centralized personnel management through systems like ACSA in Kazakhstan and ARGOS in Uzbekistan. These systems create a single point of control over workforce adjustments, meaning that headcount changes plausibly linked to automation require high-level political authorization rather than occurring through decentralized market adjustment. According to DiMaggio & Powell (1983), such processes can be classified as manifestations of coercive isomorphism. In this model, organizations exhibit similar reactions and implement similar decisions not because of market pressure, but because of direct orders from central authorities.

The second friction is hierarchical information flows. AI systems require horizontal data sharing across organizational units to generate predictions and classifications that enable automation. Post-Soviet bureaucracies were designed around vertical information flows, in which data moves up and down chains of command rather than across departments. Mussagulova (2021) identifies this feature as a persistent constraint on innovation in post-Soviet states, and Keegan's (2023) finding that digital authoritarianism reinforces rather than dismantles these hierarchies suggests that the constraint may intensify as digitalization proceeds, rather than relax. This interpretation receives independent multilateral support from the 2024 OECD Public Governance Review of Uzbekistan, which identifies 'investing in continuous professional development' and 'improving the use of data for policymaking' as priorities that remain unmet despite the country's progress in digitalization. The OECD review's recommendations are significant because they treat capability formation and digital infrastructure as two distinct policy areas. Rather than viewing the gap between them as a temporary growing pain, the review identifies this disconnect as a built-in structural feature of the current reform model.

The third friction is a risk-averse organizational culture. Pierson (2000) shows that institutional path dependence generates loss aversion among actors whose positions are defined by existing rules, making them resistant to changes that threaten their organizational niches. In bureaucratic contexts, this manifests as a reluctance to adopt AI systems that might expose existing inefficiencies or redistribute decision-making authority. The finding of Alon-Barkat & Busuioc (2023) that public officials engage in selective adherence to algorithmic advice rather than wholesale adoption reflects this dynamic.

6. Conclusion

This article examined how digital government transformation is associated with occupational restructuring and the formation of workforce capabilities in Kazakhstan and Uzbekistan. The findings show that digital upgrading in post-Soviet bureaucracies does not automatically produce proportional workforce adaptation. Instead, digital platforms, infrastructure, and administrative reforms have tended to advance faster than the institutional capacity needed to train, redeploy, and reorient civil servants. This imbalance is captured here through the concept of the reskilling paradox.

The comparison also shows that the paradox does not take a single form. In Kazakhstan, the pattern appears as a gradual compositional change within the civil service alongside persistent gaps in digital skill requirements and post-hire training. In Uzbekistan, it is expressed through a more politically driven sequence in which administrative restructuring and digital expansion took precedence over a consolidated capability-building system. Different empirical pathways were observed, but the underlying problem was similar in both cases.

These results contribute to the literature in three ways. First, the study brings task-based approaches to technological change into the analysis of post-Soviet public administration, where employment adjustment is shaped less by market competition and more by administrative hierarchy, legal mandates, and centralized personnel control. Second, it provides comparative evidence that digital government reforms and workforce restructuring do not move together in any automatic or linear way. Third, it introduces the reskilling paradox as a concept that helps explain why visible progress in digital modernization may coexist with limited adaptation in the civil service's skills base.

The broader implication is straightforward. Digital state modernization should not be evaluated solely by online services, platform expansion, or headline-level reform achievements. It should also be judged by whether governments are building the organizational and human capacity required for workforce transition. The argument should also be read in light of the study's asymmetric design, especially the more limited availability of directly comparable workforce data for Uzbekistan. Where that second dimension remains weak, technological progress will continue to coexist with capability deficits inside the bureaucracy.

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