

Comparative study of AI adoption strategy using Hofstede model between Kazakhstan and Uzbekistan

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Abstract — *The rapid global expansion of Artificial Intelligence technologies has prompted Central Asian economies to formulate ambitious national digitalization strategies, yet the cultural and institutional factors associated with AI adoption in this region remain insufficiently studied. This paper presents a qualitative comparative analysis of AI adoption strategies in Kazakhstan and Uzbekistan through the integrated lens of Hofstede’s Cultural Dimensions, the Technology-Organization-Environment framework, and the Technology Acceptance Model. Secondary data sources, including the Oxford Insights Government AI Readiness Index 2024, national AI policy documents, Hofstede’s Cultural Dimensions as an interpretive framework, and peer-reviewed academic literature, are analyzed to examine how cultural, institutional, and technological factors are associated with different national AI adoption trajectories. The findings indicate that Uzbekistan’s AI model is predominantly government-coordination-oriented, while Kazakhstan’s model is more infrastructure-oriented and reflects stronger technical capacity. Both countries exhibit comparatively weak private-sector technological maturity. The observed patterns are consistent with the proposed research hypotheses, although the study does not formally test causal relationships. The findings suggest that culturally and institutionally informed AI strategies may contribute to more context-sensitive digital transformation in transitional economies.*

Keywords — *AI adoption, Hofstede’s model, Central Asia.*

I. INTRODUCTION

The rapid expansion of Artificial Intelligence (AI) technologies is reshaping global economic structures, prompting both advanced and developing countries to adopt AI as a strategic mechanism for improving productivity, modernizing public services, and strengthening national competitiveness [1]. Nevertheless, the extent and pace of AI diffusion vary considerably across regions. Whereas technologically mature economies in North America and East Asia have developed sophisticated

AI ecosystems, Central Asian countries encounter a unique combination of structural, institutional, and socio-cultural constraints that influence the direction and sustainability of their digital transformation processes [2], [3]. Consequently, understanding these challenges requires analytical approaches that extend beyond traditional measures of infrastructure and investment to incorporate the behavioral and cultural factors affecting societal and organizational acceptance of emerging technologies.

Kazakhstan and Uzbekistan, the two largest economies in Central Asia, have both responded to the global AI agenda through ambitious national digitalization initiatives. Kazakhstan has pursued comprehensive digital reforms through the Digital Kazakhstan program, while Uzbekistan has implemented the Digital Uzbekistan 2030 agenda and introduced a dedicated AI Technologies Development Strategy [4], [2]. Despite these similarities, significant differences in AI readiness are evident. Kazakhstan demonstrates a larger contribution of the ICT sector to GDP, a higher concentration of ICT professionals, and stronger private investment activity [4]. In contrast, Uzbekistan has exhibited rapid catch-up dynamics, advancing 17 places to rank 70th in the Government AI Readiness Index 2024 and recording a comparatively higher proportion of global AI investment in 2022 [2], [5].

However, these differences cannot be fully explained by economic indicators alone. The Technology Acceptance Model (TAM) and the Technology-Organization-Environment (TOE) framework emphasize the importance of national culture as a key environmental determinant influencing technology adoption independently of financial and infrastructural factors [1], [6]. In Central Asia, psychological barriers including technophobia, concerns over employment displacement reported by as many as 90% of small business owners in Uzbekistan, and persistent reliance on conventional business practices have been identified as more substantial obstacles to AI implementation than purely technical or economic limitations [7], [5]. Geert Hofstede’s Cultural Dimensions framework, encompassing Power Distance, Individualism, Uncertainty Avoid-

ance, Masculinity, Long-Term Orientation, and Indulgence, provides an established and internationally recognized basis for analyzing these behavioral characteristics [8]. Despite its extensive application in cross-cultural studies, no previous research has systematically employed Hofstede's model to conduct a comparative assessment of AI adoption strategies in Kazakhstan and Uzbekistan. This gap represents an important omission in both the regional digital governance literature and the broader field of cross-cultural technology adoption.

This study addresses the following question: To what extent do Hofstede's Cultural Dimensions explain the differences in AI adoption strategies between Kazakhstan and Uzbekistan, and how can these cultural insights contribute to the development of more effective and context-sensitive national AI policies?

The purpose of this study is to provide a culturally informed comparative analysis of AI adoption in Kazakhstan and Uzbekistan by integrating Hofstede's Cultural Dimensions with established technology acceptance theories and empirical macroeconomic evidence, thereby generating a roadmap for culturally-aligned digital transformation strategies in transitional economies.

Research objectives:

- Compare AI readiness indicators related to macroeconomic performance, infrastructure, and investment across Kazakhstan and Uzbekistan.
- Examine how Power Distance, Uncertainty Avoidance, and collectivist tendencies may help interpret national AI strategies and private-sector adoption patterns.
- To evaluate the current state of AI infrastructure and policy frameworks in both nations using the Technology-Organization-Environment (TOE) lens.
- To identify which Hofstede dimensions are most relevant for interpreting observed differences in AI diffusion.
- To propose targeted recommendations for policymakers and business leaders to transition from top-down mandates to a grassroots innovation culture.

Research hypotheses:

H1: AI adoption contexts characterized by stronger uncertainty-avoidance tendencies and reliance on formal authority are expected to exhibit greater dependence on government-led implementation and weaker voluntary private-sector diffusion.

H2: Differences in institutional hierarchy, governance structures, and collectivist patterns are expected to be associated with differences in private-sector AI adoption between Kazakhstan and Uzbekistan.

II. LITERATURE REVIEW

The adoption of Artificial Intelligence (AI) is fundamentally reshaping the global economic landscape, serving as a critical driver for innovation, efficiency, and competitive advantage [7], [4]. In the context of Central Asia, Kazakhstan and Uzbekistan represent the two largest and most dynamic economies, each navigating a unique path toward digital transformation [2], [4], [9]. While both nations have

implemented ambitious national strategies, the rate and success of AI adoption are deeply intertwined with their respective cultural, institutional, and economic frameworks [2], [1]. This literature review examines the current state of AI adoption in these countries through the lens of Hofstede's Cultural Dimensions, established technology acceptance models, and comparative economic indicators.

A. Theoretical Framework: Hofstede's Model and AI Adoption

The TOE framework and the TAM model suggest that technological adoption is not merely a matter of technical availability but is heavily influenced by environmental contexts, including national culture [1], [6]. Geert Hofstede's model identifies five core dimensions as Power Distance, Individualism, Masculinity, Uncertainty Avoidance, and Long-term Orientation that shape how societies perceive and interact with disruptive technologies like AI [8].

- Uncertainty Avoidance (UA): Research indicates that cultures with high UA often exhibit resistance to new technologies due to perceived risks and a preference for structured, rule-governed environments [1], [10]. In transitional economies, high risk-aversion can lead to a reliance on "tried and true" traditional methods rather than experimental AI systems [7], [6].
- Long-term Orientation (LTO): While LTO typically favours strategic planning, some studies suggest a negative correlation with rapid AI adoption, as these cultures may prioritize stable, incremental change over disruptive technological leaps [1].
- Power Distance (PD): High PD can facilitate adoption if directed from the top (top-down mandates) but may also obstruct the local, problem-driven technology-pull necessary for sustainable integration [11], [6].
- Individualism vs. Collectivism: Central Asian societies tend toward collectivism, where loyalty to the group is paramount [8]. For AI adoption, this means that trust and local success stories are vital, as individuals are less likely to adopt disruptive tools without communal validation [7], [6].
- Masculinity vs. Femininity: Masculine cultures value competition, assertiveness, and material success, which can accelerate AI uptake for performance gains. Conversely, feminine cultures prioritize quality of life and solidarity, potentially slowing adoption if AI is seen as a threat to social harmony [8].
- Indulgence vs. Restraint (IVR): This dimension reflects how societies control their desires and impulses. While Central Asian studies focus heavily on the first five, IVR impacts the hedonic motivation or the pleasure derived from using new tech like AI assistants, which can influence consumer adoption rates [12].

B. The Landscape of AI Adoption in Uzbekistan

Uzbekistan has embarked on a comprehensive digital journey guided by the strategy "Digital Uzbekistan 2030" and a

specific AI Technologies Development Strategy until 2030. The public sector has become a primary testing ground, with AI being integrated into e-government portals, public health management, and anti-corruption efforts [2]. The financial sector leads in Uzbekistan with a 30% adoption rate, followed by agriculture (15%) and trade/services (20%) [5]. AI is used for credit scoring, crop yield prediction, and enhancing customer experience [13]. Despite governmental support, small businesses in Uzbekistan face significant psychological resistance. Key barriers include technophobia, fear of job loss (noted by 90% of interviewees in one study), and a deep-seated reliance on traditional operational methods [7]. Also, persistent barriers include a lack of technical expertise, with 65% of businesses struggling to find AI talent, and a significant digital divide where only 20% of rural areas have reliable internet access [5], [13]. Rigid hierarchies and “traditional leadership” mindsets have been identified as factors that negatively impact the adoption of AI-driven tools like chatbots [6], [2].

C. Kazakhstan’s AI ecosystem and its adoption

Beyond national strategy documents, Kazakhstan’s AI ecosystem is increasingly anchored in concrete computing and community infrastructure. The cornerstone is Alem.Cloud, the national supercomputing platform launched in July 2025 and built on 64 HGX servers with 512 NVIDIA H200 GPUs, delivering up to two exaflops of performance and ranking 86th in the global TOP500 list as the most powerful supercomputing cluster in Central Asia. In October 2025 this was supplemented by a second cluster, AI-Farabium, built on Kazakhtelecom’s infrastructure using NVIDIA H200 technology, ranked 103rd globally. An academic supercomputer network with a combined capacity of 42 petaflops also links Nazarbayev University, KazNU, ENU, and Satbayev University, supported by AI centers at several other universities. Governance of this infrastructure was consolidated with the creation of the Ministry of Artificial Intelligence and Digital Development in September 2025, and the government is separately advancing the Data Center Valley project in Ekibastuz to attract global hyperscalers, with preliminary demand from more than 20 companies exceeding 100 megawatts [14], [15].

On the open-source and applied-research side, Kazakh-language resources on Hugging Face include over 2,260 models tagged for the Kazakh language, spanning speech recognition, machine translation, and language modeling projects (e.g., KazakhTTS, Kaz-RoBERTa, and mGPT-Kazakh), alongside community-maintained datasets such as the Multi-Domain Bilingual Kazakh Dataset and KazCulture. The country’s central applied data-science network is DSML.KZ, a community hub for people learning, building, researching, and hiring in AI/ML across Kazakhstan, which also runs dedicated job channels. Youth engagement is driven by two Olympiad tracks: the FAIO (International AI Olympiad, hosted domestically since 2024), whose 2025 edition drew more than 400 teams, which is around 1,200 schoolchildren from nine countries in the qualifying round, with 51 teams from seven countries reaching the Almaty final; and Kazakhstan’s hosting of the

IOAI (International Olympiad in Artificial Intelligence) in Astana in August 2026, which brought together over 100 countries and around 500 participants, described by organizers as the Olympiad’s largest edition since its founding in Bulgaria in 2024 [16].

D. Comparative Indicators: Uzbekistan vs. Kazakhstan

Kazakhstan currently maintains a stronger infrastructural and investment position compared to Uzbekistan, as evidenced by various macroeconomic indicators. The share of information technology in Kazakhstan’s GDP is significantly higher at 3.8% compared to 2.1% in Uzbekistan. Furthermore, Kazakhstan leads in private sector momentum with \$350 million invested in startups, while Uzbekistan has attracted \$120 million. This disparity extends to human capital, where Kazakhstan boasts 7.8 IT specialists per 1,000 people, nearly double Uzbekistan’s density of 4.2 [4]. Despite these gaps, Uzbekistan has demonstrated aggressive catching-up behavior, rising 17 positions to 70th globally in the Government AI Readiness Index 2024 [2]. In terms of direct AI investment for 2022, Uzbekistan captured a 0.09% share of the global total, slightly outperforming Kazakhstan’s 0.06% during the same period [5].

E. Cultural Constraints and the Human Factor

The “human factor” remains a more critical barrier to AI integration in Central Asia than technical or financial limitations. Psychological resistance is widespread in Uzbekistan, where 90% of interviewees in small business sectors expressed fears of job loss and obsolescence [5], [7]. This technophobia is often rooted in a trained incapacity, where professionals such as textile engineers or traditional managers struggle to orient themselves with machine learning algorithms [7], [11]. Furthermore, a deep-seated reliance on traditional old school methods persists, with many business owners viewing AI as an unnecessary complication to processes that are perceived as “good enough” [7]. This cultural mindset is exacerbated by a significant digital divide, where rural internet access remains as low as 20%, creating a spatial dimension to the AI divide that prevents inclusive technological diffusion [5], [3].

III. METHODS

A. Research approach

This study employs a qualitative comparative case-study design supported by descriptive quantitative indicators [17]. Kazakhstan and Uzbekistan were selected as comparative cases because they are two major Central Asian economies with broadly comparable digital transformation timelines but different AI adoption trajectories. The analysis is primarily qualitative and interpretive, while quantitative indicators, including ICT sector GDP share, AI investment levels, and Government AI Readiness Index scores, are used as descriptive evidence to support cross-country comparison and triangulation. These numerical indicators are used for contextual interpretation rather than for inferential statistical testing or causal estimation.

TABLE I
OPERATIONALIZATION OF HOFSTEDÉ'S CULTURAL DIMENSIONS IN THIS STUDY

Dim.	Core Def.	Operationalization	Evidence used for interpretation
Power Distance (PD)	Unequal power/authority acceptance	Top-down, state-directed AI policy vs. bottom-up diffusion	Gov. pillar (KZ 54.75/UZ 64.71); centralized strategies
Uncertainty Avoidance (UA)	Discomfort with ambiguity, risk	Documented AI resistance; preference for regulation before adoption	90% of Uzbek SMEs report fear of job loss [7]
Individualism vs. Collectivism	Independent action vs. in-group orientation	Reliance on communal/peer validation over individual risk-taking	Weak SME diffusion; local success stories recommended
Masculinity vs. Femininity	Competitive vs. consensus/quality-of-life values	Not empirically tested; theoretical framing only	None (qualitative only)
Long-Term Orient. (LTO)	Pragmatic planning vs. short-term thinking	Inferred from multi-year, phased program design	Digital KZ/UZ 2030 framed as long-horizon strategies
Indulgence vs. Restraint (IVR)	Free gratification vs. norm-based suppression	Relevant to consumer AI but excluded from analysis	Not used (no prior Central Asia research focus) [12]

B. Data Sources

Hofstede's Cultural Dimensions are used as an interpretive framework rather than as directly comparable national measures [8]. While country-level Hofstede scores are available for Kazakhstan, a corresponding authoritative and directly comparable set of national scores for Uzbekistan is not available in the current country-comparison dataset. Therefore, a numerical comparison of Hofstede scores between Kazakhstan and Uzbekistan is not performed. Instead, Hofstede's dimensions are applied as an interpretive framework for analyzing cultural patterns associated with AI adoption. Accordingly, the empirical indicators presented in this study should not be interpreted as proxies for Hofstede country scores. The evidence combines the Oxford Insights Government AI Readiness Index (2024), national policy documents, and peer-reviewed literature. Sources were selected for institutional authority, recency (preferably 2023–2026), and contextual relevance.

The analysis followed four steps: (1) organizing evidence into cultural, policy, technological infrastructure, and private-sector adoption categories; (2) comparing Kazakhstan and Uzbekistan within the same categories; (3) interpreting the observed patterns through Power Distance, Uncertainty Avoidance, and collectivist orientation; and (4) triangulating findings across policy documents, AI readiness indicators, and academic literature. No single indicator or cultural dimension was treated as evidence of causality.

IV. RESULTS AND FINDINGS

The findings show that Kazakhstan and Uzbekistan are pursuing related but analytically distinct trajectories of AI adoption. Following the methodological design of this study, the Oxford Insights Government AI Readiness Index 2024 is used as descriptive comparative evidence rather than as a standalone statistical explanation. This source is appropriate for the present analysis because it evaluates government AI readiness across three pillars: Government, Technology Sector, and Data & Infrastructure [18].

As shown in Fig. 1, Uzbekistan records a slightly higher overall AI readiness score than Kazakhstan, with 53.45 compared to 51.41. This aggregate difference, however, masks a more important pillar-level distinction. Uzbekistan's advantage is concentrated in the Government pillar, where it scores 64.71, compared to Kazakhstan's 54.75 [18]. This result reflects the strongly state-led character of Uzbekistan's digital transformation agenda and its Artificial Intelligence Development Strategy until 2030, which defines legal, technological, and economic foundations for AI implementation in public services and priority sectors [19].

Kazakhstan demonstrates a different pattern. It performs better in the Data & Infrastructure pillar, scoring 65.93 compared to Uzbekistan's 62.14 [18]. This points to a comparatively stronger technical base for AI deployment. The result is consistent with Kazakhstan's Concept for Artificial Intelligence Development for 2024–2029, which emphasizes Smart Data Ukimet, national data infrastructure, data processing centres, supercomputing capacity, a national AI platform, and fibre-optic connectivity [20].

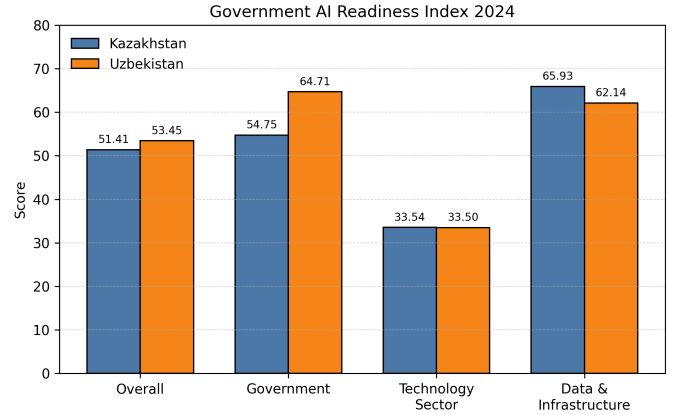


Fig. 1. Government AI Readiness Index 2024 comparison between Kazakhstan and Uzbekistan.

The Technology Sector pillar is the weakest area for both countries. Kazakhstan scores 33.54, while Uzbekistan scores 33.50, making the difference between them practically negligible [18]. This is one of the most important findings of the comparison. It shows that AI readiness in both countries is more developed at the level of government strategy and infrastructure than at the level of private-sector technological maturity. In Uzbekistan, this interpretation is supported by evidence that private-sector AI adoption is constrained by limited access to capital, high computing costs, talent shortages, regulatory uncertainty, and uneven digital literacy among micro, small, and medium-sized enterprises [21].

These findings support the Technology–Organization–Environment interpretation used in this study. Kazakhstan's relative advantage is located mainly in the technological environment, whereas Uzbekistan's advantage is located in the policy and governance environment. At the organizational level, however, both cases remain constrained. National AI

strategies do not automatically translate into firm-level adoption unless enterprises possess the skills, resources, incentives, and institutional confidence required to implement AI systems.

The findings are consistent with H1. The central role of government in both countries indicates that AI adoption is likely to proceed through top-down initiatives, official strategies, and public-sector demonstration effects. This pattern is consistent with Hofstede’s cultural framework, where Power Distance and Uncertainty Avoidance help explain why formal authority, institutional trust, and risk reduction influence technology adoption [22], [23].

The evidence is also consistent with H2, although with important qualifications. Kazakhstan’s stronger infrastructure score may provide better conditions for diversified AI applications across sectors, while Uzbekistan’s stronger Government score indicates faster progress through centralized coordination. Nevertheless, the evidence does not allow culture to be treated as the sole explanatory factor. Infrastructure, human capital, investment, regulation, and technology-sector maturity remain equally important determinants of AI adoption.

Overall, the results show that Kazakhstan’s AI adoption model is more infrastructure-oriented, while Uzbekistan’s model is more government-coordination-oriented. Hofstede’s framework helps explain why state legitimacy, institutional trust, and risk reduction are central to AI adoption in both countries. At the same time, the weak Technology Sector pillar demonstrates that the next stage of AI development in Kazakhstan and Uzbekistan must focus on private-sector diffusion, AI skills, practical pilot projects, and support for small and medium-sized enterprises.

V. DISCUSSION & CONCLUSIONS

A. Main research findings

The main research finding is that AI adoption in Kazakhstan and Uzbekistan follows different institutional logics rather than a single linear path of technological progress. The comparison shows that Uzbekistan’s AI trajectory is mainly government-coordination-oriented, while Kazakhstan’s trajectory is more infrastructure-oriented. This distinction demonstrates that AI readiness in Central Asia is shaped not only by technological capacity, but also by the way states organize authority, reduce uncertainty, and build institutional trust around emerging technologies.

In the case of Uzbekistan, AI adoption is closely linked to centralized policy direction. The country’s Artificial Intelligence Development Strategy until 2030 frames AI as an instrument for public-sector modernization, economic development, and administrative efficiency [19]. This finding is consistent with recent cross-national research showing that Power Distance and Uncertainty Avoidance are relevant for understanding how societies respond to advanced technologies [24]. In this context, state leadership functions not only as regulation, but also as a mechanism for legitimacy, coordination, and risk reduction.

Kazakhstan presents a different pattern. Its AI trajectory is more strongly connected to infrastructural capacity and the

TABLE II
COMPARATIVE AI READINESS AND INVESTMENT INDICATORS:
KAZAKHSTAN VS. UZBEKISTAN

Dimension	Kazakhstan	Uzbekistan	Source
Overall Govt. AI Readiness Index (2024)	51.41	53.45	Oxford Insights [18]
Government pillar (AI Readiness Index)	54.75	64.71	Oxford Insights [18]
Technology Sector pillar (AI Readiness Index)	33.54	33.50	Oxford Insights [18]
Data & Infrastructure pillar (AI Readiness Index)	65.93	62.14	Oxford Insights [18]
ICT share of GDP	3.8%	2.1%	Khusainov et al. [4]
Private-sector AI/startup investment	\$350 million	\$120 million	Khusainov et al. [4]
IT specialists per 1,000 people	7.8	4.2	Khusainov et al. [4]
Share of global AI investment (2022)	0.06%	0.09%	Khaitbaeva et al. [5]

development of a national digital ecosystem. The Concept for the Development of Artificial Intelligence for 2024-2029 emphasizes data integration, supercomputer capacity, and digital connectivity [20]. Kazakhstan’s comparative advantage lies not only in the formal design of the policy, but also in the technical foundations required for the implementation of sectoral AI. However, the practical value of this infrastructure depends on whether it can be converted into applied use cases across public administration, business, education, and industry.

A further finding is that both countries remain dependent on state-led AI development because private-sector diffusion is still comparatively weak. The external environment is developing through national strategies and infrastructure programs, but organizational readiness remains less mature [25]. This helps explain why national readiness does not automatically translate into widespread firm-level adoption. Hofstede’s model complements TOE and TAM by explaining why similar technologies may be accepted, resisted, or institutionalized differently across national contexts [23].

B. Limitations

Several limitations of this study warrant acknowledgment. First, the absence of primary data, including interviews with policymakers, AI practitioners, or enterprise-level survey instruments, means findings reflect patterns documented in existing literature rather than independently verified field evidence. Second, Hofstede’s cultural framework and available country-level cultural indicators carry construct-validity limitations and should therefore be interpreted with appropriate caution. Third, the rapidly evolving nature of AI policy in both countries means some referenced strategies may have been updated or superseded between the time of writing and publication. Fourth, the reliance on English and Russian language sources may have introduced selection bias, potentially underrepresenting Uzbek-language scholarship and local policy discourse. Future research incorporating longitudinal primary data collection, enterprise-level survey instruments, and mul-

tilingual source analysis would substantially strengthen the empirical basis for the conclusions presented here.

C. Practical recommendations for companies and policy-makers

For Kazakhstan, policy should focus on converting existing infrastructure advantages into broader sectoral and SME adoption through targeted pilots, incentives, and public-private partnerships. For Uzbekistan, strong government coordination should be complemented by greater technical capacity, AI literacy, and firm-level readiness. In both countries, clearer AI governance, data-protection requirements, and regional knowledge sharing could reduce uncertainty and support responsible private-sector diffusion.

D. Future research

Future research should validate these interpretations using longitudinal primary data from AI decision-makers and enterprises in both countries. Sector-specific studies and comparisons with other Central Asian economies could test the generalizability of the observed patterns. Alternative cultural frameworks, including GLOBE and the World Values Survey, could also address the limitations of Hofstede-based indicators.

E. Conclusion

This study examined how cultural and institutional factors may contribute to differences in AI adoption strategies between Kazakhstan and Uzbekistan. The comparison indicates two distinct trajectories: Kazakhstan is more infrastructure-oriented, while Uzbekistan is more government-coordination-oriented.

The evidence is consistent with both research hypotheses, although causal relationships were not formally tested. Power Distance and Uncertainty Avoidance may be associated with greater reliance on government-led AI implementation, while institutional and infrastructural differences may influence private-sector adoption. However, these patterns cannot be attributed to culture alone and should be interpreted alongside investment, human capital, regulation, and technological capacity.

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