Fortifying Uzbekistan's integrity landscape: Harnessing India's tech-driven anti-corruption strategies

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ABSTRACT

Corruption poses significant challenges to sustainable development and social justice in Uzbekistan. This paper explores how Uzbekistan can strengthen its anti-corruption framework by leveraging emerging technologies and drawing lessons from India's experience in using information and communication technology (ICT) to combat corruption. The study employs a qualitative research methodology, analysing data from government reports, case studies, and expert interviews to identify specific areas where Uzbekistan can learn from India's successes and challenges in applying ICT solutions. The findings highlight several key ways ICT can bolster anti-corruption efforts in Uzbekistan, such as increasing transparency through e-governance platforms, improving accountability via digital monitoring systems, and enabling citizen participation with online reporting tools. The paper provides concrete examples and data from India demonstrating how technologies like biometrics, blockchain, and data analytics have helped detect fraud, streamline bureaucratic processes, and empower citizens to report corruption. However, the research also reveals critical legal, institutional and cultural barriers Uzbekistan must address to effectively implement these tech-based approaches, such as outdated regulations, lack of technical expertise, and public distrust. Comparing India and Uzbekistan's contexts, the paper offers tailored recommendations for how Uzbekistan can adapt India's ICT models to overcome its unique constraints. The study concludes that while technology is not a panacea, strategically integrating ICT into Uzbekistan's anti-corruption arsenal – with insights from India's experience – can be a powerful tool to promote good governance, curb corruption, and ultimately advance social justice for citizens. More research is needed to assess the long-term impacts and scalability of specific ICT interventions.

1. Introduction

1.1. Background of corruption in Uzbekistan

Corruption exhibits a diverse and omnipresent challenge, notoriously eluding a straightforward definition due to its intricate and evolving characteristics [1]. Transparency International characterizes corruption as the exploitation of power entrusted by others for personal benefit. This characterization captures various manifestations of corruption, such as graft, misappropriation, favouritism, and insider dealing. Not only does corruption erode confidence in public establishments but it also obstructs economic progress and societal coherence [2]. The identification and eradication of corrupt activities are essential in nurturing effective governance and enduring development. Within the purview of this study, grasping the concept of corruption is pivotal

for examining ways through which Information and Communication Technologies (ICT) can be deployed to counteract and thwart dishonest practices efficiently. Through the application of ICT tools aimed at enhancing transparency, responsibility, and community participation, state bodies along with enterprises can boost their anti-corruption endeavours while cultivating an ethos of integrity within public management systems [3].

Undeniably, the fight against corruption holds paramount significance, especially within governance spheres. Corruption acts as a deterrent to legal adherence, skews the trajectory of economic growth, and diminishes faith in governing bodies. To promote openness, responsibility, and moral behaviour across both public and private domains, implementing robust measures against corruption is critical. The deployment of Information and Communication Technologies (ICT) enhances the abilities of states and entities in their quest against corrupt

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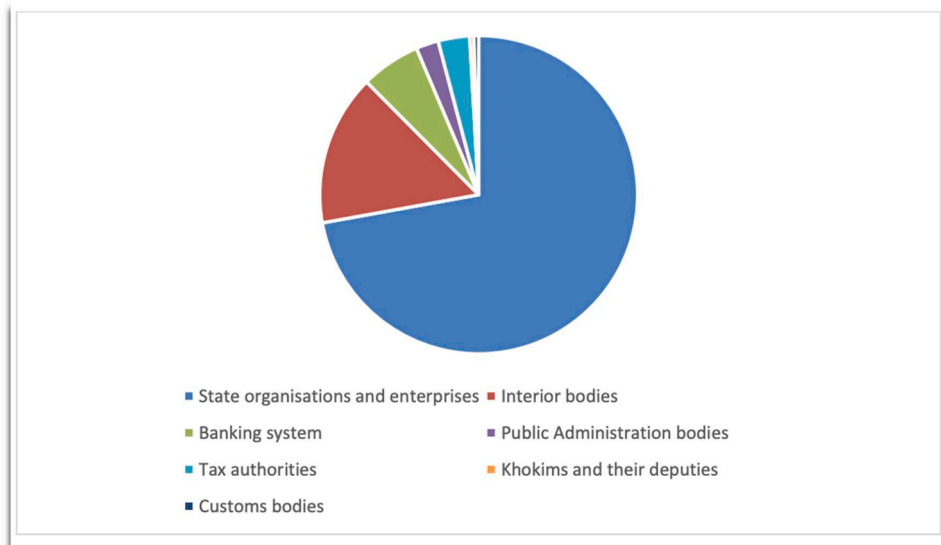*E-mail address:* abhithommandru@gmail.com (A. Thommandru).

Fig. 1. Officials prosecuted for corruption offences in 2017 in Uzbekistan (Breakdown by authorities).

activities by improving operations' efficacy, utilizing data examination techniques, and introducing clear procedures [4]. This technology facilitates continuous oversight, reduces manual handling through automation, and assures safer information repositories, making it challenging for malpractices to remain hidden. Additionally, ICT plays a significant role in empowering people to anonymously disclose any wrongful deeds, promoting an atmosphere where accountability is highly valued. Adopting ICT strategies in combating corrupt practices remains essential for fostering exemplary governance and maintaining uprightness throughout decision-making endeavours.

Uzbekistan has been grappling with deep-rooted corruption since its independence in 1991. The absence of transparency, accountability, and effective anti-corruption mechanisms has allowed corrupt practices to permeate various levels of society and government. Reports highlight widespread acts of embezzlement, bribery, and favouritism within public services and government bodies, hindering foreign investment and national development [5]. Uzbekistan's Soviet legacy, centralized political system, and weak adherence to the rule of law have created a conducive environment for the proliferation of corrupt activities. Recognizing this historical context is crucial in formulating effective strategies to combat corruption and improve governance in Uzbekistan. Robust anti-corruption frameworks are essential for achieving good governance and sustainable development. These frameworks foster a culture of transparency, accountability, and integrity across government and private sectors. By implementing strong anti-corruption measures, countries can reduce the risks associated with corrupt practices, enhance investor confidence, promote economic growth, and maintain the rule of law [6]. Studies show that countries with effective anti-corruption mechanisms experience increased foreign direct investment, better economic performance, and improved social welfare indicators. Moreover, comprehensive anti-corruption legislation and its strict enforcement help to cultivate a culture of ethical behaviour and legal compliance across all levels of society. Therefore, investing in the development and implementation of robust anti-corruption frameworks is not only an ethical imperative but also critical for driving sustainable growth and prosperity [7].

1.1.1. Significance of tech adoption in anti-corruption efforts

The adoption of technology has become increasingly significant in modern anti-corruption efforts, enabling enhanced monitoring and detection of irregularities. The use of digital tools, such as data analytics and machine learning, has streamlined government processes, reduced

human intervention, and increased transparency in transactions [8]. In the context of Uzbekistan, where corruption challenges persist, the strategic deployment of technology-driven solutions could revolutionize traditional anti-corruption approaches. By embracing cutting-edge technologies, Uzbekistan aims to strengthen its governance structures, enhance monitoring capabilities, and promote accountability among public officials. Emphasizing technology integration in anti-corruption initiatives can catalyse systemic reforms, boost public confidence, and set Uzbekistan on a path towards sustainable development.

In battling corruption, the significance of Information and Communication Technology (ICT) is crucial for boosting openness, responsibility, and effectiveness in public sector bodies (Refer Fig. 1). ICT enables the conversion of physical documents into digital formats, simplifies procedures, and permits instant surveillance of dealings, thus diminishing chances for corrupt practices. As noted in, employing ICT has evidently decreased levels of graft in numerous nations by offering safer and more transparent ways for communication between the public and state departments. With tools such as internet platforms to report misconducts, analytic software to spot irregularities, and electronic governance systems for distributing services at their disposal, entities fighting corruption can improve their probing skills and deter unauthorized actions [9]. Henceforth, making ICT an integral part of strategies against corrupt behaviour can reinforce organizational structures while encouraging principles of proper administration which substantially aids continuous progress and enhances community welfare.

By harnessing the power of big data analytics, the capability of anti-corruption initiatives to identify misconduct trends, irregularities, and suspicious activities within government systems can be substantially improved. Through analysing immense datasets from diverse origins such as transactions financially oriented, procurement in public sectors, and declarations of assets, it's feasible for big data analytics to uncover deviations and corrupt practices that may remain hidden otherwise. This methodological analysis furnishes agencies focused on combating corruption with insights that are both actionable and timely; thereby enhancing their ability to pinpoint where interventions ought to be directed most effectively while optimizing the deployment of resources. Furthermore, governance processes stand to gain in terms of transparency and accountability through implementing real-time surveillance alongside evaluation mechanisms enhanced by big data analytics. Thusly embedding big data analytical techniques into strategies against corruption could mark a transformative shift towards more fortified policies grounded on empirical evidence in battling graft.

The use of E-Government Systems to fight corruption could transform how transparency and accountability are enhanced across state bodies. Such systems, defined by their conversion of services and dissemination of information into digital formats, present an avenue for improved efficiency and lesser chances for corrupt activities [10]. By making bureaucratic procedures more efficient and introducing web-based interfaces for public involvement, the government can limit corruption opportunities while boosting trust from the populace. Nonetheless, achieving this requires strong online security strategies, development of skills among state officials, and a dedication towards being transparent. It is critical to make sure e-government platforms are accessible and easy to use for everyone; failing which might leave those in marginalized communities out of these advantages' reach. Henceforth, addressing technical, institutional, as well as societal considerations is vital in leveraging the full potential of e-government systems against corruption effectively.

In the fight against corruption, transparency and accountability play pivotal roles, and the use of Information and Communication Technologies (ICT) brings forth inventive methods to improve these elements. By deploying ICT resources like digital platforms for exposing corrupt activities, analytical tools for identifying trends in wrongdoing, and electronic governance systems for streamlined service provision, state authorities can boost both transparency and accountability within their functions. With ICT deployment, the public gains simpler access to information, engaging actively in policy formulation processes while ensuring that government officials are held responsible for their conduct. The significant influence of ICT on battling corruption highlights why it's critical to weave technology into governmental frameworks to foster trustworthiness and uphold principles of integrity. Consequently, government strategists must place a high emphasis on embracing ICT innovations to fortify anti-corruption agencies and enhance openness in government operations [11].

1.2. Comparative research

To provide a comprehensive analysis, this study employs a qualitative research methodology. The research relies on a combination of primary and secondary data sources, including government reports, academic publications, and expert interviews. The data collection process involves a systematic review of relevant literature, as well as semistructured interviews with key stakeholders, including government officials, anti-corruption experts, and civil society representatives. The collected data is analysed using thematic analysis techniques to identify patterns, trends, and best practices in the use of ICT for anti-corruption efforts. The methodology adopted in this study ensures a rigorous and evidence-based approach to understanding the potential of leveraging emerging technologies to enhance anti-corruption measures in Uzbekistan, drawing from India's experiential insights.

2. Challenges and loopholes in Uzbekistan's anti-corruption efforts

2.1. Legal loopholes and policy issues

Uzbekistan's anti-corruption legal framework, while improved in recent years, still suffers from significant loopholes that undermine its effectiveness. The country's primary anti-corruption law, adopted in 2017, fails to comprehensively cover all forms of corruption and lacks precise definitions for critical concepts such as "conflict of interest," "illicit enrichment," and "abuse of power." This ambiguity creates room for interpretation and makes it difficult to hold corrupt actors accountable. Moreover, the penalties prescribed for corruption offenses are often disproportionately lenient compared to the severity of the crime, with fines being more common than imprisonment. This weak deterrent effect is compounded by the fact that Uzbekistan's Criminal Code does not hold legal entities liable for corruption, focusing only on individuals [12].

Inconsistencies and gaps also exist across different pieces of legislation and government policies related to anti-corruption. For instance, while the Law on Public Procurement aims to increase transparency, it does not fully align with best practices in preventing corruption in public contracting. Uzbekistan has yet to join the WTO Agreement on Government Procurement, which would require further reforms. Additionally, the country's tax and customs regulations contain loopholes that enable corrupt practices like bribery and smuggling. Policy coordination between various government agencies responsible for fighting corruption remains weak, resulting in fragmented and sometimes contradictory approaches. These legal and policy deficiencies create a permissive environment for corruption to thrive [13].

2.2. Lack of transparency and accountability

Uzbekistan's governance system is characterized by a pervasive lack of transparency that facilitates corruption. Decision-making processes within state institutions are often opaque, with limited public access to information on how policies are formulated, budgets are allocated, and contracts are awarded. Despite the adoption of a Law on Transparency in 2014, implementation has been slow and inconsistent. Many government bodies do not proactively disclose key documents such as annual reports, financial statements, and audit results. The absence of a comprehensive freedom of information law further hinders citizens' ability to request and obtain public records [14].

This opacity creates opportunities for officials to abuse their power without fear of exposure. Corrupt practices like bribery, embezzlement, and nepotism thrive in an environment where there is little risk of detection or consequences. Accountability mechanisms to check government power remain weak. The parliament exercises minimal oversight over the executive branch, and the judiciary lacks independence, with courts often deferring to the interests of political elites. Uzbekistan's Supreme Audit Institution, tasked with scrutinizing public spending, has limited capacity and authority to investigate and sanction financial misconduct.

Moreover, public officials are rarely held accountable for corruption due to a pervasive culture of impunity. High-profile cases involving senior government figures are seldom prosecuted, and when they are, the process lacks transparency. Lower-level bureaucrats caught engaging in petty corruption often face only minor disciplinary measures. Without robust systems to detect wrongdoing and impose penalties, there is little incentive for officials to act with integrity. The absence of transparency and accountability thus perpetuates a vicious cycle of corruption.

2.3. Ineffective enforcement mechanisms

While Uzbekistan has established various institutions and mechanisms to combat corruption, their effectiveness remains limited. The country's main anti-corruption body, the Anti-Corruption Agency, was created in 2020 to replace the previous Inter-Departmental Commission. However, concerns persist about its independence and capacity to fulfill its mandate. The agency reports directly to the president, which could compromise its impartiality, particularly when investigating cases linked to the ruling elite. Resource constraints and a lack of specialized expertise among staff also hamper the agency's ability to conduct complex investigations and prosecute high-level offenders [15].

Coordination between different law enforcement bodies responsible for fighting corruption, such as the Prosecutor General's Office, the Ministry of Interior, and the State Security Service, is often poor. Overlapping mandates and interagency rivalries impede information sharing and joint operations. Corruption cases are frequently passed between different agencies, leading to delays and opportunities for evidence to disappear or be tampered with. In some instances, law enforcement officials themselves are complicit in corrupt networks,
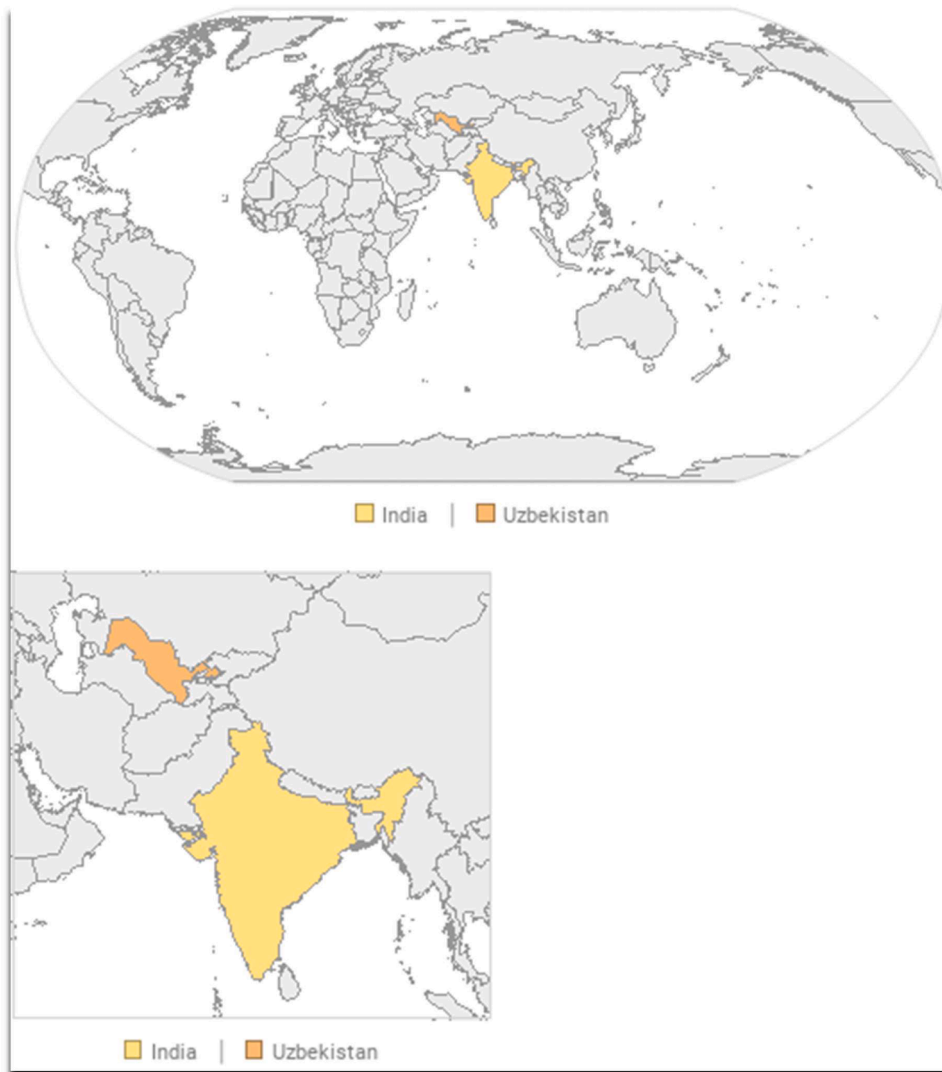
Fig. 2. The image shows two maps - a world map and a zoomed-in map of a specific region. In both maps, the countries of India and Uzbekistan are highlighted in yellow.

undermining the credibility of investigations [16].

Uzbekistan's court system also faces challenges in effectively adjudicating corruption cases. Judges are susceptible to political influence and bribery, compromising their independence and impartiality. The legal process is often opaque, with trials conducted behind closed doors and verdicts not publicly explained. Conviction rates for corruption offenses are low, reflecting both the difficulty of gathering admissible evidence and the weakness of prosecutors' cases. Even when convictions are secured, sentences are often lenient and inconsistently applied.

Another critical gap is the inadequate protection afforded to whistleblowers who report corruption. While Uzbekistan has a law on whistleblowing, it falls short of international best practices and does not provide robust safeguards against retaliation. Government officials who witness wrongdoing are required to report it through internal channels, but they have little assurance of confidentiality or immunity from reprisals. Private sector employees and civil society activists who expose corruption also face significant risks, including harassment, intimidation, and spurious lawsuits. Without stronger legal protections and support systems, insiders are deterred from coming forward with valuable information [17].

2.4. Limited public participation and awareness

Effectively tackling corruption requires active participation and buy-in from citizens, but public engagement in anti-corruption efforts remains limited in Uzbekistan. Years of authoritarian rule and suppression of civil liberties have fostered a sense of apathy and disillusionment among the population. Many Uzbeks view corruption as an intractable problem and an inevitable part of daily life. A survey conducted by the World Bank in 2020 found that only 34 % of respondents believed ordinary citizens could make a difference in the fight against corruption (Refer Fig. 2).

This pessimism is compounded by a lack of awareness about the causes and consequences of corruption, as well as the avenues available for reporting and seeking redress. Civic education on anti-corruption issues is minimal, with few public outreach campaigns or school programs dedicated to the topic. Media coverage of corruption tends to be superficial and focused on individual scandals rather than systemic analysis. As a result, citizens often struggle to understand their rights and the legal mechanisms they can use to hold officials accountable [18].

Even when citizens are aware and motivated to take action, they face significant barriers to participation. Uzbekistan's civil society sector remains weak, with restrictive regulations and government harassment

Aspect	India	Uzbekistan
Anti-Corruption Laws	- Prevention of Corruption Act, 1988 - Lokpal and Lokayuktas Act, 2013 - Whistle Blowers Protection Act, 2014	- Law on Combating Corruption, 2017 - Criminal Code of the Republic of Uzbekistan, 1994 - Law on Civil Service, 2016
Anti-Corruption Agencies	- Central Vigilance Commission (CVC) - Central Bureau of Investigation (CBI) - Lokpal (not yet fully functional)	- Anti-Corruption Agency of the Republic of Uzbekistan - General Prosecutor's Office - Department for Combating Economic Crimes under the General Prosecutor's Office
Oversight Mechanisms	- Comptroller and Auditor General (CAG) - Public Accounts Committee (PAC) of Parliament - Judiciary	- Chamber of Accounts (Supreme Audit Institution) - Parliamentary Commission on Combating Corruption and Increasing the Efficiency of Anti-Corruption Measures - Judiciary
Whistleblower Protection	- Whistle Blowers Protection Act, 2014 (implementation pending)	- Limited legal protection for whistleblowers under the Law on Combating Corruption, 2017
Asset Declaration	- Mandatory for public servants under the Lokpal and Lokayuktas Act, 2013	- Mandatory for public officials under the Law on Combating Corruption, 2017
International Conventions	- United Nations Convention against Corruption (UNCAC), ratified in 2011	- United Nations Convention against Corruption (UNCAC), ratified in 2008
Challenges	- Implementation and enforcement of anti-corruption laws - Delays in judicial proceedings - Political influence on anti-corruption agencies	- Lack of independence of anti-corruption agencies - Limited transparency and accountability in government processes - Weak implementation of asset declaration requirements

Fig. 3. Comparative analysis of anti-corruption frameworks: India and Uzbekistan.

limiting the ability of NGOs to operate freely. Anti-corruption activists and journalists who attempt to expose wrongdoing often face retaliation, including arbitrary detention, trumped-up charges, and smear campaigns. The fear of reprisals deters many from speaking out or engaging in grassroots activism (Refer Fig. 3).

Moreover, channels for citizens to report corruption and provide input on anti-corruption policies are underdeveloped. While some government agencies have established hotlines and online portals for complaints, the effectiveness of these mechanisms is questionable. Response times are often slow, and there is little transparency on how complaints are handled or resolved. Public consultations on draft laws and policies related to anti-corruption are rarely conducted in a meaningful way, with short timeframes and limited outreach to stakeholders [19].

Transforming public attitudes and mobilizing citizens to actively participate in anti-corruption efforts will require sustained investment in education, awareness-raising, and trust-building measures. The government must create an enabling environment for civil society to thrive and establish credible platforms for citizen engagement. Protecting the rights of activists, whistleblowers, and journalists is crucial to encouraging public participation. Only by empowering citizens as partners in the fight against corruption can Uzbekistan hope to achieve lasting change [20].

3. India's experience in combating corruption through ICT

3.1. Overview of India's anti-corruption landscape

India has long grappled with endemic corruption that permeates various levels of government and society. Transparency International's 2020 Corruption Perceptions Index ranks India 86th out of 180 countries, indicating a persistent problem. However, in recent years, India has made significant strides in leveraging information and communication technology (ICT) to combat corruption and promote good governance. The Indian government has recognized the potential of digital tools to increase transparency, accountability, and citizen participation in the fight against graft [21].

India's anti-corruption framework encompasses a range of laws, institutions, and initiatives. The Prevention of Corruption Act, 1988 is the primary legislation that criminalizes corruption offenses. The Central Vigilance Commission (CVC) serves as the apex anti-corruption body, overseeing investigations and prosecutions. The Lokpal and Lokayuktas Act, 2013 established independent ombudsman institutions at the national and state levels to investigate allegations of corruption against public officials. In addition to these legal and institutional mechanisms, India has increasingly turned to ICT solutions to tackle corruption [22].

3.2. Key ICT initiatives in India's anti-corruption efforts

3.2.1. e-Governance and digitization of public services

One of the most significant ways India has employed ICT to combat corruption is through the digitization of public services and the adoption of e-governance platforms. By moving government processes online, India has reduced opportunities for bribery and rent-seeking that often occur in face-to-face interactions between citizens and officials. The Digital India initiative, launched in 2015, aims to transform the country into a digitally empowered society and knowledge economy. It includes a wide range of projects to deliver government services electronically, such as the Common Services Centers (CSCs) that provide access to e-services in rural areas [23].

A notable example is the e-procurement system, which has been implemented across various government departments to enhance transparency in public contracting. The Government e-Marketplace (GeM) portal, launched in 2016, has streamlined procurement processes, reduced paperwork, and enabled real-time monitoring of transactions. It has resulted in significant cost savings and increased competition among vendors. Similarly, the digitization of land records through the National Land Records Modernization Programme (NLRMP) has helped combat corruption in property transactions by providing citizens with easy access to accurate and updated land ownership information.

3.2.2. Citizen engagement platforms and whistleblowing mechanisms

ICT has also been leveraged to facilitate citizen engagement and

provide channels for reporting corruption. India has established several online platforms and mobile applications that allow citizens to lodge complaints, provide feedback on public services, and report grievances. For example, the Prime Minister's Office launched the mygov.in portal in 2014 as a platform for citizen participation in governance. It enables citizens to share ideas, suggestions, and concerns directly with government agencies.

The Central Vigilance Commission operates an online complaint management system called VIGEYE (Vigilance Eye) that allows individuals to report corruption anonymously. It also provides a mobile app for submitting complaints and tracking their status. Several states have set up similar online portals and helplines to receive corruption complaints. These digital channels have made it easier for whistle blowers to come forward and have helped uncover numerous cases of graft [24].

3.2.3. Data analytics and artificial intelligence for fraud detection

India is increasingly harnessing the power of data analytics and artificial intelligence (AI) to detect and prevent corruption. By analysing large volumes of government data, these technologies can identify patterns and anomalies that may indicate fraudulent activities. For instance, the Income Tax Department uses data analytics to flag suspicious transactions and identify potential tax evaders. It has also developed an AI-based system called Project Insight to analyse data from multiple sources and detect tax non-compliance [25].

The Comptroller and Auditor General (CAG) of India, the country's supreme audit institution, has also embraced data analytics to enhance its audit processes. It has set up a Centre for Data Management and Analytics (CDMA) to analyse large datasets and uncover irregularities in government spending. The use of data analytics has enabled the CAG to conduct more focused and risk-based audits, leading to the detection of significant leakages and wasteful expenditure.

3.3. Success stories and impact assessment

India's use of ICT in anti-corruption efforts has yielded several notable successes. One prominent example is the Aadhaar system, a biometric identification program that has been used to plug leakages in social welfare schemes. By linking benefits to unique Aadhaar numbers and using digital payment systems, the government has been able to eliminate fake beneficiaries and reduce corruption in the distribution of subsidies. A study by the World Bank estimated that Aadhaar-based authentication in the public distribution system (PDS) for food grains led to a 10–12 % reduction in leakage. Another success story is the implementation of the PAHAL scheme for the direct transfer of LPG (cooking gas) subsidies to beneficiaries' bank accounts. By removing intermediaries and using digital payments, the scheme has reduced diversion and black marketing of subsidized cylinders. It has resulted in significant savings for the government and ensured that benefits reach the intended recipients. The use of data analytics has also led to the detection of large-scale tax evasion and money laundering. In 2016, the Income Tax Department conducted a data analysis exercise that identified over 1 million high-risk cases of tax non-compliance. The subsequent investigations resulted in the detection of undisclosed income worth billions of dollars. Similarly, the use of AI and machine learning by the Financial Intelligence Unit (FIU) has helped uncover complex money laundering schemes and terrorist financing networks.

3.4. Lessons learned and challenges faced

While India's experience in using ICT to combat corruption offers valuable lessons, it also highlights several challenges that need to be addressed. One key lesson is the importance of political will and leadership in driving anti-corruption reforms. The successful implementation of ICT initiatives requires strong commitment from the highest levels of government and sustained efforts to overcome bureaucratic

resistance.

Another lesson is the need for robust legal and regulatory frameworks to support the use of technology in anti-corruption efforts. India has taken steps to update its laws to recognize electronic evidence and enable the use of digital tools in investigations and trials. However, there are still gaps in the legal framework, particularly in areas such as data protection and privacy. A significant challenge is the digital divide that exists in India, with large segments of the population lacking access to the internet and digital services. This limits the reach and impact of ICT-based anti-corruption initiatives. Efforts need to be made to bridge this divide and ensure that the benefits of technology reach all citizens, particularly the most vulnerable and marginalized. There are also concerns about the potential misuse of technology for surveillance and violation of civil liberties. The collection and use of personal data by government agencies must be subject to strict safeguards and oversight to prevent abuse. Striking the right balance between using technology for anti-corruption purposes and protecting individual rights is an ongoing challenge.

Finally, while ICT can be a powerful tool in the fight against corruption, it is not a silver bullet. Technology alone cannot solve the deep-rooted structural and cultural issues that underlie corruption in India. It must be accompanied by broader reforms in areas such as judicial efficiency, public service delivery, and political financing. Building a culture of integrity and accountability requires sustained efforts to change attitudes and behaviours. India's experience in leveraging ICT to combat corruption offers valuable insights for other countries seeking to tackle this pervasive problem. The use of e-governance, citizen engagement platforms, and data analytics has shown promising results in increasing transparency, detecting fraud, and empowering citizens. However, the challenges faced by India also underscore the need for a holistic and context-specific approach that addresses the legal, institutional, and societal barriers to effective anti-corruption efforts. By learning from India's successes and challenges, countries like Uzbekistan can adapt and tailor ICT solutions to their own unique circumstances in the fight against corruption.

The scrutiny of employing ICT to fight corruption brings out crucial insights for Uzbekistan, underscoring the need to deploy technology to boost openness, liability, and efficiency in efforts against corruption. By analysing triumphant techniques exercised by other nations, Uzbekistan could mould exemplary practices tailored to its unique scenario. Stressing ICT's significance might spur the creation of strong institutional structures that aid in the surveillance and documentation of corrupt deeds. Moreover, pouring resources into ICT foundations and initiatives aimed at building capability can capacitate concerned parties to wield digital implements adeptly in their quest against corruption. The fusion of tech-centric remedies promises a transformative alteration in how Uzbekistan tackles graft by simplifying procedures, curtailing chances for wrongdoing, and cultivating an ethos of honourability and moral conduct. It becomes critical for Uzbekistan to place high on its agenda the embracement of ICT within its anti-graft strategies to encourage enduring transformation and nurture commendable governance manners [11].

4. Case studies on successful implementation of ICT in anti-corruption efforts

4.1. Case study 1: Estonia's E-Governance system

The E-Governance mechanism of Estonia is often celebrated as a ground-breaking illustration showing the capacity of Information and Communication Technologies (ICT) to efficiently tackle corruption. Through adopting digital means for interactions between citizens and government, Estonia has made bureaucratic operations more efficient, heightened transparency, and reduced chances for corrupt activities. Utilizing blockchain technology within its digital framework has guaranteed records are kept secure and unalterable, which in turn boosts

confidence in transactions conducted by the government. The triumphs of Estonia's E-Governance system present an influential example for other countries wishing to diminish corruption via ICT solutions. By examining the methods and experiences of Estonia, crucial lessons can be learned about crafting strong anti-corruption strategies with the aid of technological innovations [26].

4.2. Case study 2: Kenya's Huduma Platform

The Huduma Platform from Kenya is a prime illustration of utilizing Information and Communication Technology (ICT) to fight corruption successfully. This platform provides a unified location for citizens to obtain government services, curtailing bureaucratic procedures that are susceptible to corrupt activities. With the digitalization of service provisions, there has been an upsurge in transparency and efficiency in Kenya, diminishing paths for corrupt behavior. Through the aid of Huduma, individuals can seamlessly acquire crucial services without having direct interactions that might enable corruption. This study accentuates how ICT can transform governance practices by fostering accountability and honesty within public departments. The Huduma Platform in Kenya acts as an archetype for different nations aspiring to employ technology efficiently against corruption practices. By imitating such approaches and infrastructures, countries could better their service provisions, simplify operations, and build trust amongst citizens and government entities. The accomplishments from this Kenyan strategy highlight the significant capacity of ICT to battle corruption on a widespread scale [27].

4.3. Case study 3: Singapore's Corruption Reporting Portal

The innovative ICT mechanism known as Singapore's Corruption Reporting Portal, a tool crafted to boost both transparency and accountability in the ongoing battle against corruption. Inaugurated in 2016, this portal permits individuals to confidentially report instances of bribery and misconduct, thus fostering greater communal engagement in preventing corrupt practices. Through enabling people to easily and securely disclose corruption, a notable uptick in reported incidents has been observed in Singapore, showcasing this ICT solution's efficacy. The triumph of the portal accentuates the critical role that technology plays in enhancing anti-corruption measures and advocating for exemplary governance. The narrative of Singapore sheds light on how impactful ICT can be when devoted to countering corruption and underlines the urgency for akin initiatives across different nations aimed at cultivating an ethos of integrity and responsibility. This case analysis offers indispensable perspectives on harnessing technological instruments to aid anti-corruption endeavours while encouraging other countries to implement comparable methodologies [28].

1. Legal and Policy Reforms
   - Updating laws and regulations related to e-governance, data protection, cybersecurity, and digital evidence to ensure they are robust and aligned with international best practices. India's Information Technology Act and Aadhaar Act provide useful models.
   - Establishing clear policies and guidelines on the use of technology for anti-corruption purposes, such as standards for data collection, sharing and analysis. Uzbekistan can draw from India's National e-Governance Plan which sets out a roadmap for digitizing public services.
   - Streamlining bureaucratic processes and reducing red tape through business process re-engineering and automation. India's efforts to simplify tax filing and company registration using online portals offer relevant lessons.
   - Strengthening whistle-blower protection laws and creating secure online channels for reporting corruption. India's Whistle Blowers Protection Act, 2014 and online grievance redressal systems are instructive.

2. Capacity Building and Training
   - Conduct intensive capacity building programs for government officials, law enforcement agencies, and anti-corruption bodies on how to effectively leverage technology. India's e-governance competency framework and digital investigation training provide useful templates.
   - Partner with universities and training institutes to develop specialized courses on ICT for anti-corruption. India's collaborations with IITs and NITs on cybersecurity and data analytics courses are worth emulating.
   - Launch public awareness campaigns to educate citizens on how to use digital platforms to access services and report corruption. India's Digital Saksharta Abhiyan on digital literacy offers valuable insights.

3. Multi-Stakeholder Collaboration and Partnerships
   - Establish multi-stakeholder forums and working groups to jointly design, implement and monitor ICT initiatives for accountability. India's multi-stakeholder consultations on Aadhaar and Open Government Data are good practices.
   - Foster partnerships with civil society organizations to develop citizen-centric ICT tools for grievance redressal, social audits, and community monitoring. Collaborations between the Indian government and NGOs like Janaagraha and Transparency International offer useful models.
   - Engage with the media to leverage ICTs for investigative journalism and fact-checking to expose corruption. Partnerships between the Indian government and data journalism initiatives like IndiaSpend and Factchecker.in are worth studying.

4. Monitoring and Evaluation Frameworks

Investing in Information and Communication Technology (ICT) solutions as a method to curb corruption, Uzbekistan's journey necessitates robust monitoring and evaluation (M&E) structures for its success. This investigation is set on unearthing the significant function of M&E mechanisms in overseeing advancements, appraising outcomes, and validating the efficiency of ICT strategies aimed at diminishing corrupt practices. Taking cue from efficient models like Digital India Dashboard and National e-Governance Service Delivery Assessment by India, Uzbekistan holds the potential to sculpt extensive M&E outlines featuring precise criteria and aims. By forming specific surveillance divisions within bodies fighting corruption, outfitted with competencies for data scrutiny and illustrative visualizations, Uzbekistan might mirror substantial frameworks such as those seen with India's Central Vigilance Commission or Karnataka's Bhoomi e-governance initiative. Routine checks along with assessments of impact will spotlight obstacles including unforeseen repercussions; simultaneously nurturing an atmosphere predisposed towards shared wisdom will support iterative enhancement in combating graft via ICT schemes. Utilizing systematic plus evidence-driven tactics towards M&E shall empower Uzbekistan to refine its battle against malfeasance thereby step forward into governance that epitomizes transparency alongside accountability.

Frameworks for Monitoring and Evaluation (M&E) are essential in the effectiveness of Information and Communication Technology (ICT) strategies, especially when dealing with corruption. These systems offer a methodized way to evaluate the impact and success of these measures, ensuring they are carried out with transparency and accountability. By setting specific metrics and goals, nations such as Uzbekistan can track advancements and base decisions on gathered information. Units dedicated to monitoring within agencies fighting corruption, along with sophisticated tools for analysing data, can significantly improve the performance of M&E structures, as evidenced by initiatives in India. Conducting regular assessments an evaluations is critical for recognizing obstacles and mitigating unforeseen negative outcomes, thus permitting ongoing refinement of anti-corruption actions via ICT deployments. Additionally, promoting an environment where learning and exchanging knowledge among all involved parties can amplify the

accomplishments of these efforts enabling authorities to mimic successful approaches while steering clear from common errors in their battle against corruption.

Within the sphere of initiatives for combating corruption through ICT, designing a sturdy framework for Monitoring and Evaluation (M&E) proves crucial. Uzbekistan could glean valuable lessons from exemplary setups like the Digital India Dashboard and National e-Governance Service Delivery Assessment observed in India. These structures embed definite evaluations and objectives to measure both impactfulness and efficiency of ICT undertakings. Moreover, forming specific task groups focused on oversight within bodies fighting corruption, mirroring the structure seen with India's Central Vigilance Commission or Karnataka's Bhoomi e-management scheme—outfitted with techniques for data scrutiny and illustration—can markedly amplify M&E systems founded on empirical analysis. Conducting periodic reviews and determining impacts as demonstrated by India's DARPG along with NITI Aayog's methodical policy examinations can unveil obstacles, pressure points, plus unforeseen effects tied to ICT based interventions. Encouraging an atmosphere where learning together with dissemination of knowledge across governmental sectors is common practice—as found in India's online portal dedicated to e-administration knowledge—might additionally refine M&E processes while promoting mutual educational experiences among peers.

Components such as metrics and objectives are pivotal elements within any Framework for Monitoring and Evaluation (M&E) designed to measure the success and influence of ICT measures in diminishing corruption. It is imperative for Uzbekistan to give precedence to crafting extensive M&E frameworks, seeking inspiration from eminent models like the Digital India Dashboard of India and its National e-Governance Service Delivery Assessment that utilize distinct objectives and metrics for tracking advancement. Furthermore, the creation of specialized units focused on monitoring inside bodies combatting corruption, outfitted with sophisticated tools for data examination and depiction, could refine the oversight mechanism. Instances like the Central Vigilance Commission of India or Karnataka's Bhoomi initiative in e-governance illustrate how efficaciously data-guided M&E frameworks can be employed. Periodical evaluations along with impact analyses stand essential in uncovering obstacles as well as ancillary outcomes, while references such as DARPG and NITI Aayog from India present invaluable guidelines for assessments grounded in evidence-based policy-making. Promoting a learning ethos alongside knowledge exchange via platforms akin to India's Knowledge Portal on e-governance may endorse mutual education among various government entities and agencies thereby encouraging incessant enhancement coupled with wide dissemination of superior methods.

Units specifically tasked with monitoring, found within bodies fighting corruption, are crucial to verify the success of initiatives using information and communication technology (ICT) in battling corrupt practices. Equipped with tools for analysing data and visualizing it, these groups can deliver instant evaluations on the results of efforts against corruption. By looking at effective examples such as the Central Vigilance Commission in India and Karnataka's Bhoomi e-governance scheme, Uzbekistan might do well to think about creating similar specialized monitoring teams to boost openness and responsibility in its fight against dishonesty. Through conducting consistent reviews and assessments of outcomes, these teams are able to pinpoint issues, obstacles, and unexpected effects from ICT-based strategies, thus allowing those who make policies to decide wisely on stronger tactics against misconduct. Moreover, promoting an environment where learning is valued and knowledge exchanged freely — a principle demonstrated by India's e-governance Knowledge Portal — could support ongoing enhancement and novelty in combating underhandedness.

Frequent studies and assessments regarding their impact stand as essential parts of effective oversight and examination blueprints when talking about ICT manoeuvres for battling corruption. For the triumph of these endeavours, Uzbekistan ought to emphasize crafting all-

encompassing M&E outlines that bring in distinct gauges and objectives shaped to gauge the influence and proficiency of ICT schemes on diminishing dishonest practices. Getting motivated from triumphant precedents such as India's Digital India Dashboard along with its National e-Governance Service Delivery Appraisal could lend substantial enlightenment for Uzbekistan's strategy. Moreover, setting up specialized supervision squads packed with techniques for data scrutiny and depiction, reminiscent of India's Central Vigilance Commission plus Karnataka's Bhoomi e-administration initiative, may amplify the supervising activity. The execution of consistent evaluations alongside assessments concerning their impact will additionally assist in revealing obstacles, chokepoints, and unplanned outcomes, paving the way for indispensable refinements and enhancements. By nurturing an ambiance inclined towards schooling and sharing know-how via channels like India's e-governance Knowledge Gateway, Uzbekistan might enable mutual learning among various governmental entities and offices, consequently amplifying the efficiency of ICT actions directed at eradicating corruption.

For enhancing the impact and efficiency of ICT measures in combatting corruption, it is vital to identify obstacles, roadblocks, and unforeseen effects. Uzbekistan needs to implement thorough monitoring and evaluation (M&E) strategies that use clear metrics and objectives, taking cues from effective examples such as the Digital India Dashboard or National e-Governance Service Delivery Assessment seen in India. Also important is the creation of specialized units for monitoring within agencies fighting corruption, which would mirror initiatives like those under India's Central Vigilance Commission or Karnataka's Bhoomi e-governance scheme, equipped with advanced tools for data analysis and visualization to fortify M&E frameworks substantially. Carrying out periodic evaluations and assessments are crucial for spotting issues and unexpected results; insights gained from India's evidence-based policy reviews by DARPG and NITI Aayog can be incredibly instructive. Besides this point emphasizes fostering a culture where knowledge transfer among governmental bodies executing ICT projects comes second-nature—an approach reflected through participation in forums like India's e-governance Knowledge Portal—to continuously elevate anti-corruption mechanisms' innovativeness.

For the purpose of battling corruption in Uzbekistan using ICT strategies, it's imperative to form solid frameworks for monitoring and assessment. Eyeballing triumphs in nations such as India could guide Uzbekistan towards emphasizing the crafting of all-encompassing M&E blueprints that possess definite benchmarks and objectives for gauging the influence of ICT schemes. Beyond this, establishing specialized units charged with observance tasks inside bodies combatting corruption, which are also furnished with tools for analysing data, stands crucial for adeptly noting progress and making necessary adjustments. Evaluations carried out systematically alongside assessments of impact play a vital role in pinpointing hurdles and accidental outcomes born from employing ICT methods. Moreover, nurturing an atmosphere inclined toward learning together with exchanging know-how across governmental sectors enhances anti-corruption ventures' success rates considerably. By heeding these advisories and absorbing lessons from established effective practices elsewhere, Uzbekistan is well-positioned to amp up its crackdown on corrupt activities via ICT endeavours.

5. Road-map for better implementation

5.1. Phase 1: lay the foundation

Uzbekistan should conduct a comprehensive assessment of its existing anti-corruption legal and policy frameworks. This diagnostic exercise will help identify gaps, inconsistencies, and opportunities for leveraging ICT. In parallel, the government should establish a multi-stakeholder advisory committee comprising representatives from relevant government agencies, tech experts, civil society organizations, and academia. This diverse group will be tasked with guiding the

development of a National Anti-Corruption Technology Strategy that outlines the vision, priorities, and implementation plan for integrating ICT into anti-corruption efforts. To build public understanding and support for this tech-driven approach, the government should launch a nationwide awareness campaign using a mix of traditional and digital media channels. Key messages should highlight the potential of ICT to enhance transparency, accountability, and citizen participation in the fight against corruption. Securing adequate financial resources is critical for the success and sustainability of these efforts. The government should allocate dedicated budget lines and actively seek support from international donors and development partners who have experience in supporting similar initiatives in other countries.

5.2. Phase 2: strengthen legal and institutional frameworks

With the foundation in place, the next step is to strengthen the enabling environment for the effective use of ICT in anti-corruption. This involves drafting and enacting amendments to existing anti-corruption laws and regulations. These legal reforms should aim to recognize the admissibility of digital evidence in corruption cases, enable secure data sharing between relevant agencies, and provide robust protections for whistleblowers who report corruption through ICT channels. In tandem with legal reforms, the government should streamline and digitize the processes for reporting, investigating, and prosecuting corruption cases. Establishing a central online portal and database for all corruption complaints will help improve case management, monitoring, and analysis. To ensure that anti-corruption personnel are equipped to handle the influx of digital data, the government should invest in specialized training programs for investigators, prosecutors, and judges on collecting, analyzing, and presenting digital evidence in court. Given the sensitive nature of corruption-related data, it is crucial to establish clear data privacy and security protocols that are compliant with international standards. This includes implementing strict access controls, encryption, and anonymization measures to protect the identities of whistleblowers and prevent unauthorized disclosure of personal information.

5.3. Phase 3: develop and pilot ICT solutions

With the necessary legal and institutional safeguards in place, Uzbekistan can start designing and deploying concrete ICT solutions for anti-corruption. One key priority should be the development of an e-governance platform that digitizes high-risk government services such as public procurement, business licenses, and permits. By automating these processes and minimizing face-to-face interactions between citizens and officials, e-governance can help reduce opportunities for bribery and favouritism. To enable citizens to safely report corruption and provide feedback on public services, the government should develop mobile apps and SMS-based tools that allow for anonymous and confidential reporting. These tools should be widely publicized and easily accessible, especially for marginalized communities who may face barriers to reporting through traditional channels. Blockchain technology offers promising applications for secure and transparent record-keeping. Uzbekistan could pilot the use of blockchain in corruption-prone sectors such as land registration and customs clearance. By creating tamper-proof and auditable records of transactions, blockchain can help prevent fraud and enable real-time monitoring of potential irregularities. To fully harness the power of data analytics for anti-corruption, Uzbekistan should establish a dedicated data analysis unit within its anti-corruption agency. This unit would be responsible for collecting and integrating data from various government databases, monitoring suspicious transactions, and deploying AI algorithms to detect patterns and red flags. Building partnerships with universities and tech companies can help accelerate the development and customization of cutting-edge anti-corruption solutions.

5.3.1. Phase 4: scale up and evaluate

Based on the results and lessons learned from the pilots, successful ICT solutions should be integrated into the government's core anti-corruption infrastructure and processes. This phase focuses on expanding the reach and impact of these tools, while continuously refining them based on user feedback and evolving needs. To ensure that citizens are empowered to use ICT tools for anti-corruption, the government should launch a national digital literacy program. This program could include online tutorials, community workshops, and school curricula that teach citizens how to access e-government services, report corruption through mobile apps, and engage in data-driven advocacy. Periodic audits and impact evaluations are essential for assessing the effectiveness of ICT interventions in reducing corruption. These assessments should use a mix of quantitative and qualitative methods to measure changes in corruption perceptions, experiences, and reporting rates. The findings should inform ongoing improvements and course corrections. Establishing knowledge-sharing partnerships with other countries that have successfully implemented similar initiatives can provide valuable insights and best practices. Uzbekistan could join regional and global networks of anti-corruption agencies and participate in peer learning exchanges. As technology continues to evolve, Uzbekistan should explore the potential of emerging tools such as AI and machine learning to further enhance its analytical capacities. This could include developing predictive models to identify high-risk transactions or sectors, or using natural language processing to analyze unstructured data from social media and news reports.

5.4. Phase 5: sustain the momentum

To achieve lasting impact, Uzbekistan must institutionalize a data-driven and technology-enabled approach to anti-corruption. This requires mainstreaming ICT tools and skills across all levels and branches of government, and creating a supportive ecosystem for innovation. As new forms of corruption emerge and technologies advance, it is important to regularly update ICT tools, training programs, and standard operating procedures. This could involve establishing a dedicated unit or task force within the government to scan the horizon for emerging trends and develop agile responses. Fostering a culture of experimentation, learning, and adaptation within anti-corruption institutions is key to staying ahead of the curve. This may require incentivizing staff to propose new ideas, providing opportunities for cross-functional collaboration, and creating safe spaces for piloting and iterating on new approaches. Finally, Uzbekistan should leverage its experience and leadership to advocate for the wider adoption of ICT in anti-corruption efforts across the region and beyond. This could involve sharing case studies, tools, and resources through regional forums and global platforms, and encouraging other countries to invest in technology-driven solutions. By positioning itself as a regional hub for anti-corruption innovation, Uzbekistan can help drive a broader shift towards data-driven and tech-enabled approaches to promoting transparency and accountability.

6. Conclusion

This study has explored how Uzbekistan can enhance its anti-corruption efforts by harnessing emerging technologies and assimilating lessons from India's experience in deploying ICT solutions. The research highlights several critical ways in which ICT can strengthen Uzbekistan's anti-corruption framework, such as increasing transparency through e-governance platforms, improving accountability through digital monitoring systems, and facilitating citizen participation through online reporting tools. Concrete examples and data from India demonstrate the potential of technologies like biometrics, blockchain, and data analytics in detecting fraud, streamlining bureaucratic processes, and empowering citizens to report corruption. However, the study also reveals significant legal, institutional, and cultural barriers
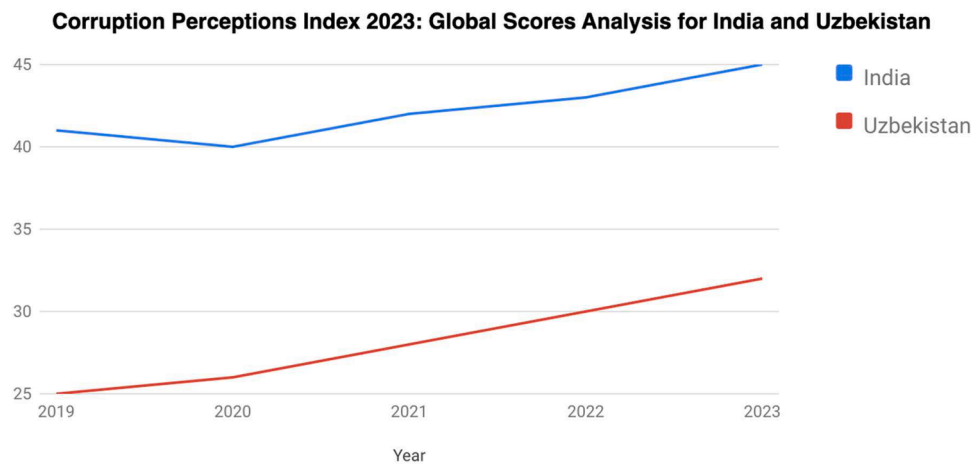
Fig. 4. ICT initiatives in India's anti-corruption [29].

that Uzbekistan must address to effectively implement these tech-driven approaches, including outdated regulations, lack of technical expertise, and public distrust. The findings of this research have important implications for Uzbekistan's anti-corruption strategies and policies. First, the study underscores the need for Uzbekistan to develop a comprehensive and integrated ICT framework for anti-corruption, aligned with its national development goals and international commitments. This requires a strategic shift from piecemeal and isolated technology interventions to a holistic and systemic approach that leverages ICT across all stages of the anti-corruption value chain, from prevention and detection to investigation and prosecution. Second, the research highlights the importance of adapting and contextualizing ICT solutions to Uzbekistan's unique socio-political realities, rather than blindly

replicating models from other countries. This necessitates a deep understanding of the country's legal, institutional, and cultural ecosystems, and tailoring ICT interventions to address specific corruption risks and governance challenges. Finally, the study emphasizes the critical role of political will and leadership in driving the adoption and sustainability of ICT for anti-corruption. This calls for strong commitment and action from policymakers, anti-corruption champions, and civil society leaders to create an enabling environment for technology-driven reforms. While this study provides valuable insights into the potential of ICT for anti-corruption in Uzbekistan, it also highlights several areas for further research. First, there is a need for more empirical and longitudinal studies to assess the long-term impacts and sustainability of specific ICT interventions on corruption outcomes in Uzbekistan. This includes examining the unintended consequences and potential risks of technology-driven approaches, such as privacy breaches, data misuse, and digital exclusion. Second, future research should explore the role of emerging technologies like artificial intelligence, machine learning, and predictive analytics in enhancing the efficiency and effectiveness of anti-corruption efforts in Uzbekistan. This requires collaboration between computer scientists, data analysts, and anti-corruption experts to develop and test innovative solutions. Finally, comparative studies with other countries in the region and beyond can provide valuable insights into the contextual factors and best practices that influence the success of ICT for anti-corruption in different settings (See Figs. 5 & 6).

Ultimately, the fight against corruption in Uzbekistan requires sustained political will, collective action, and public support. While technology can be a powerful tool in this fight, it is not a silver bullet. The findings of this study underscore the need for a multi-pronged and inclusive approach to anti-corruption that combines legal, institutional, and cultural reforms with technological innovations. This requires strong leadership and commitment from the government, civil society, media, and private sector to create a culture of integrity, accountability,

Fig. 5. Corruption Perceptions Index 2023: Global Scores Analysis.

Corruption Perceptions Index 2023: Global Scores Analysis for India and Uzbekistan

Fig. 6. Corruption Perceptions Index 2023: Global Scores Analysis for India and Uzbekistan.

and transparency. It also demands active citizen engagement and participation in monitoring and reporting corruption, enabled by user-friendly and secure ICT platforms. By leveraging the insights and recommendations of this study, and drawing inspiration from India's experience, Uzbekistan can build a more robust and effective anti-corruption ecosystem that harnesses the power of technology for promoting good governance, curbing corruption, and advancing social justice for all its citizens (Fig. 4).

CRediT authorship contribution statement

Abhishek Thommandru: Conceptualization, Investigation, Resources, Writing – original draft. **Fazilov Farkhod Maratovich:** Supervision, Validation, Writing – review & editing. **Niyozova Salomat Saparovna:** Project administration, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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