DIGITALIZATION OF INFRASTRUCTURE AND DECARBONIZATION IN CENTRAL ASIA: OPPORTUNITIES AND CHALLENGES

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Motivational background

- Digitalization has been identified as a potential strategy for the support of decarbonization efforts in various sectors, including energy. The International Energy Agency (IEA) estimates that the implementation of digital technologies in power plants and network infrastructure has the potential to generate savings of approximately USD 80 billion annually between 2016-2040, which translates to around 5% of the total power generation costs worldwide (IEA, 2017).
- Central Asia has made progress in developing digital ecosystems. The region has made noteworthy strides in the establishment of digital infrastructures, including robust telecommunications networks and reliable internet connectivity. The progress among the countries of the region is uneven; however, the region overall has witnessed the expansion of e-government services enabling citizens to access information, submit applications, and conduct various administrative tasks online.
- The economies of Central Asia countries are highly carbon intensive and are thus inefficient. This is due to the existing built infrastructure, which is heavily dependent on fossil fuels, particularly coal and natural gas, for energy production and industrial activities (Sabyrbekov & Ukueva 2019). Sixty to eighty percent (60-80%) of GHG emissions in the region are from the energy sector, which was predominantly built in the mid twentieth century.
- The topic of decarbonization of infrastructure in Central Asia remains rather under-researched.

Research objective

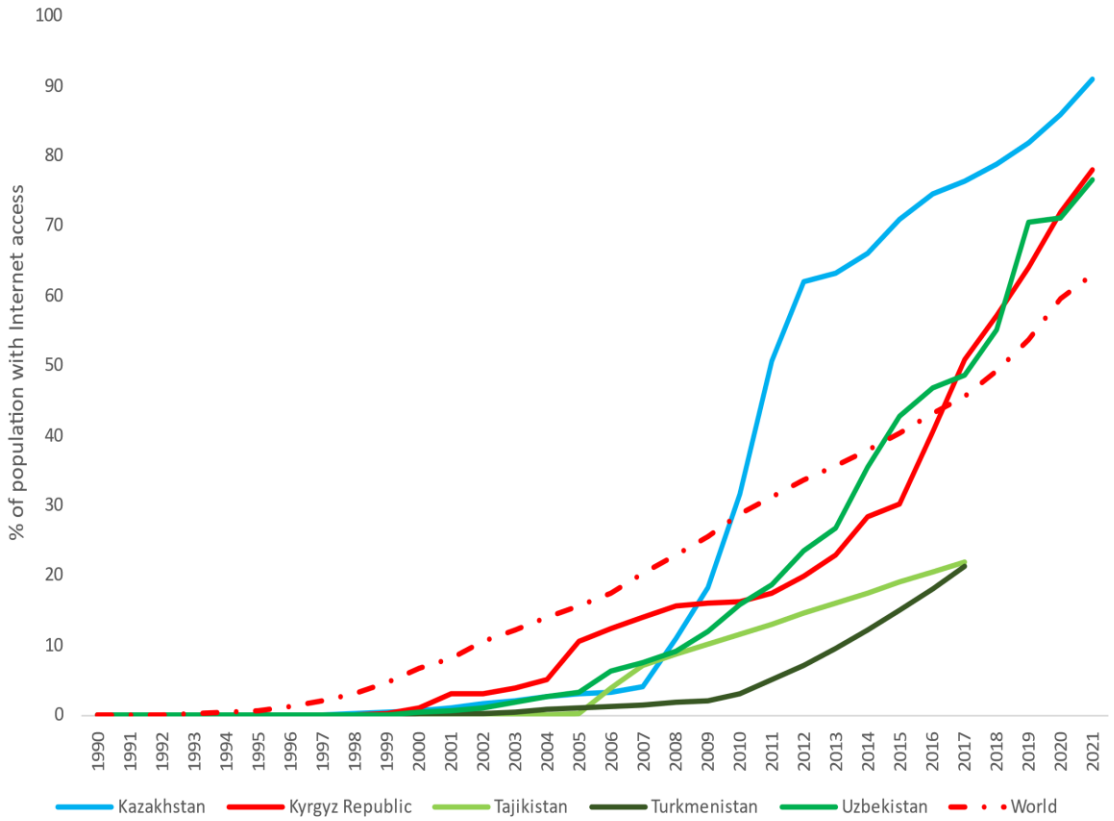
- Central Asia, with its rich natural resources and rapid urbanization, stands to benefit significantly from integrating digitalization and clean energy solutions into its infrastructure planning.

- This research aims to explore the main opportunities and challenges of digitalizing infrastructure and promoting decarbonization in Central Asia, focusing on areas such as
  - the current state of affairs and plans for digital infrastructure,
  - enabling environments, local capacity,
  - and the impact of digitalization on decarbonization efforts.

Methodology

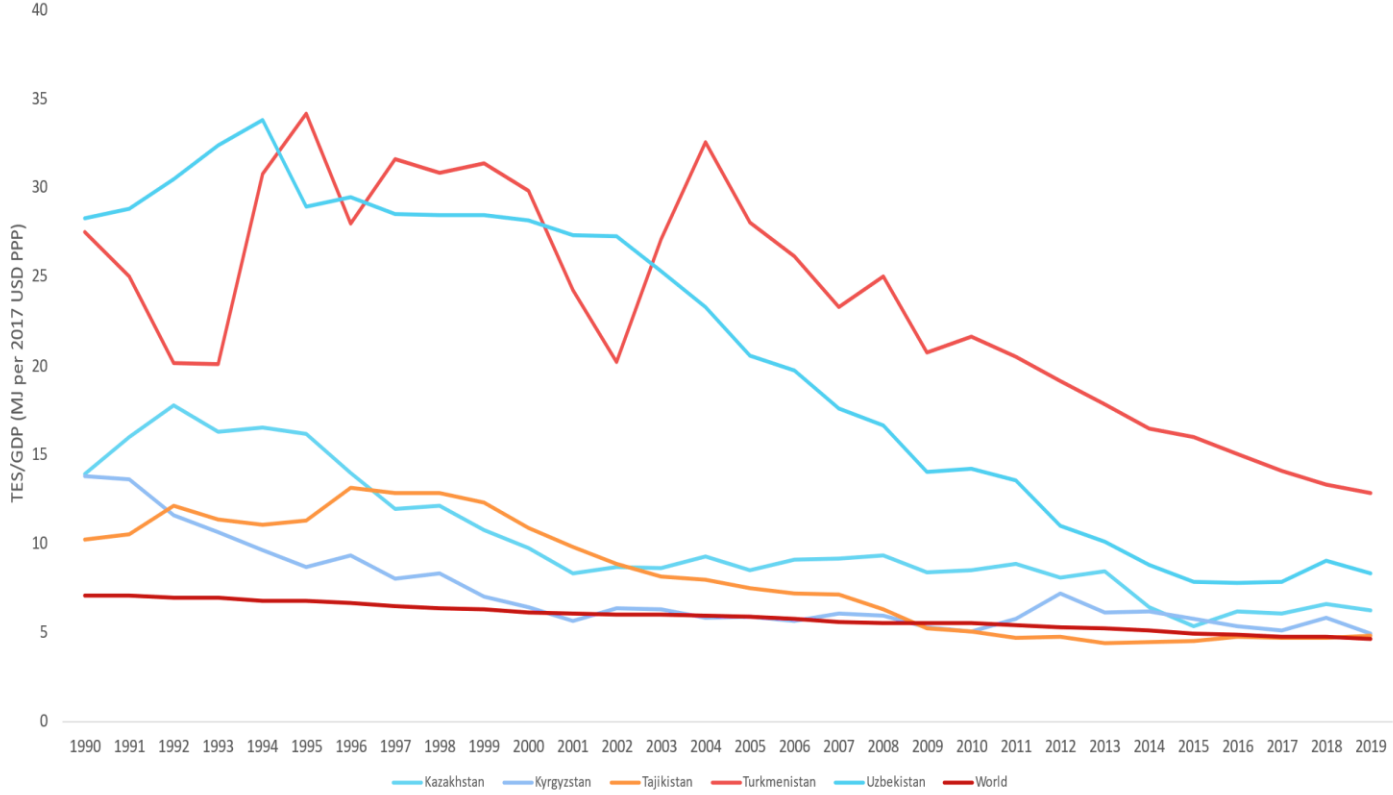
- The research methodology relied on three main methods.
  - First, a desk review was conducted on the existing literature on the topics of digitalization and decarbonization in Central Asia, along with an analysis of the related national strategies and programs.
  - Second, an online survey was administered to experts in the field, both within and outside the region. The survey was distributed to well-known experts through social media platforms, as well as through direct requests made by the researchers and the CAREC Think Tank Network (CTTN) Secretariat.
  - Last, econometric modelling was employed, utilizing state-of-the-art methods from the literature and the latest available data on digitalization and decarbonization in the region.

Internet users as a percentage of total population.



Source: World Development Indicators

Energy intensity of GDP by Central Asian country.

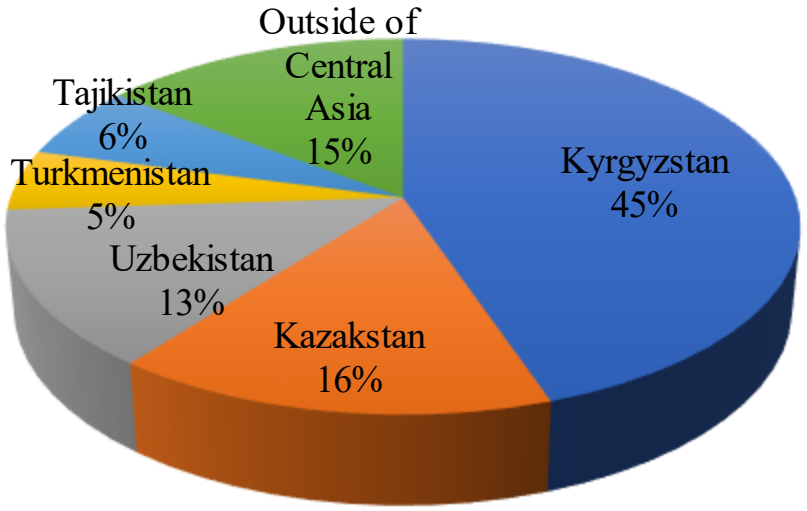


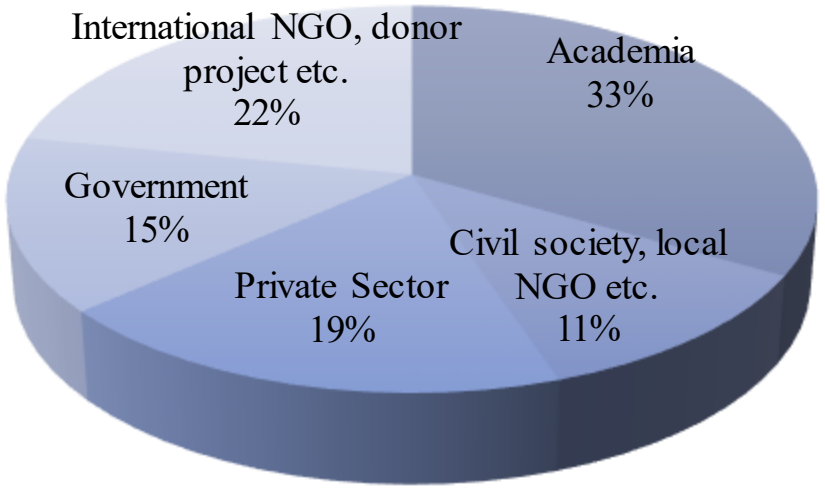
Source: IEA (2021), World Energy Balances.

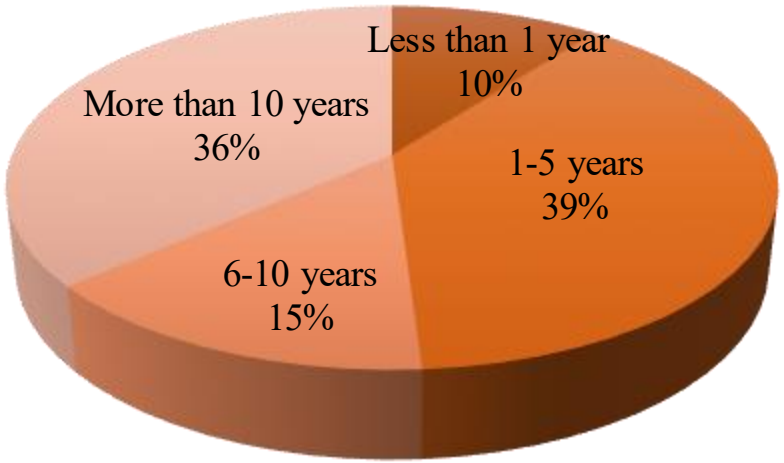
Survey

- The survey was designed to gather insights and opinions from a diverse range of stakeholders involved in digitalization and decarbonization initiatives in Central Asia
- The survey was conducted online using a widely accessible platform, specifically Google Forms. The data collection period spanned from May 22nd to May 31st, 2023.
- A total of 98 respondents participated in the survey, 72 in English and 26 in Russian.
- The questionnaire included several main parts that focused on gathering information about the past state of affairs, challenges, opportunities, and policy recommendations regarding digitalization and decarbonization in Central Asia.
- The questionnaire aimed to provide a comprehensive understanding of the past landscape, inform policy recommendations, and identify areas for further investigation

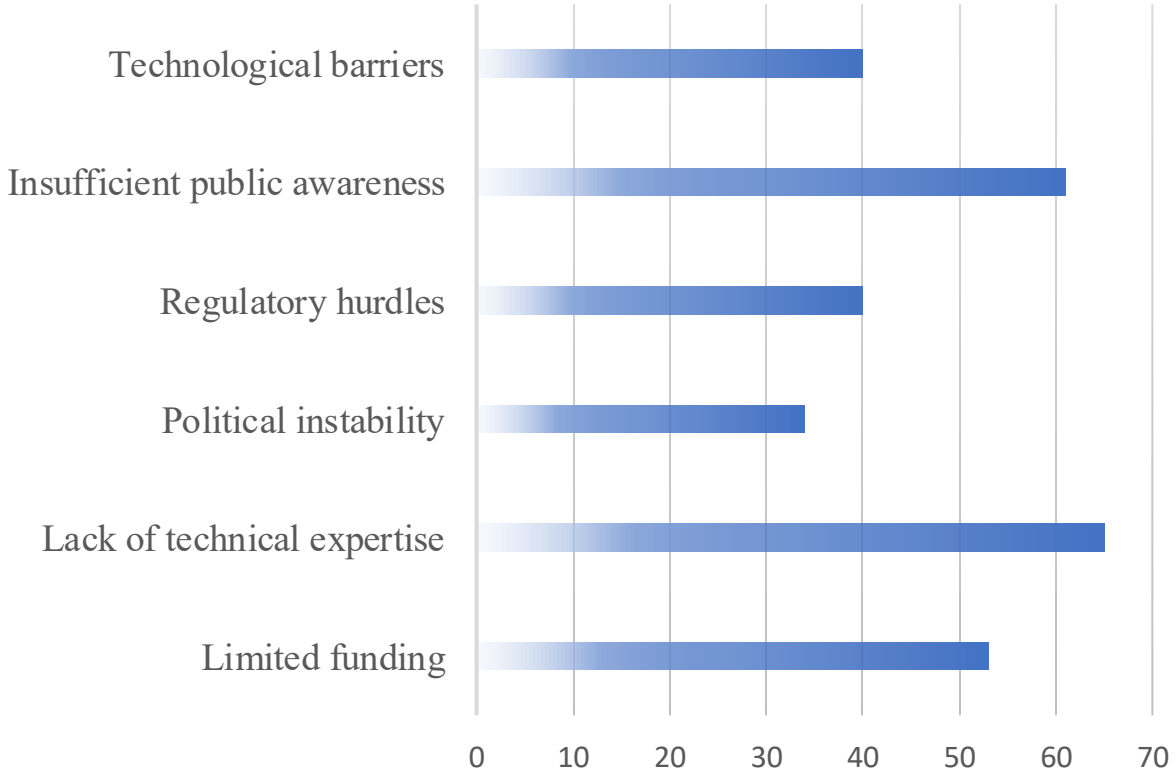
Survey Findings





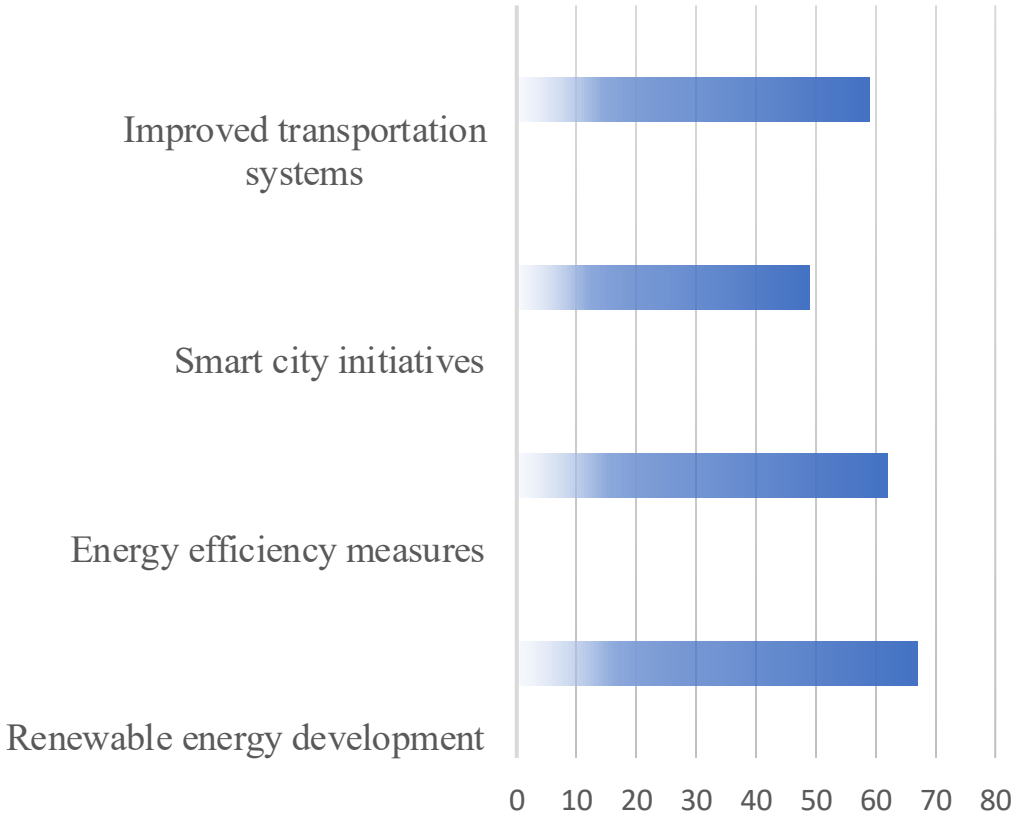


MAJOR CHALLENGES IN IMPLEMENTING DIGITALIZATION AND DECARBONIZATION PROJECTS

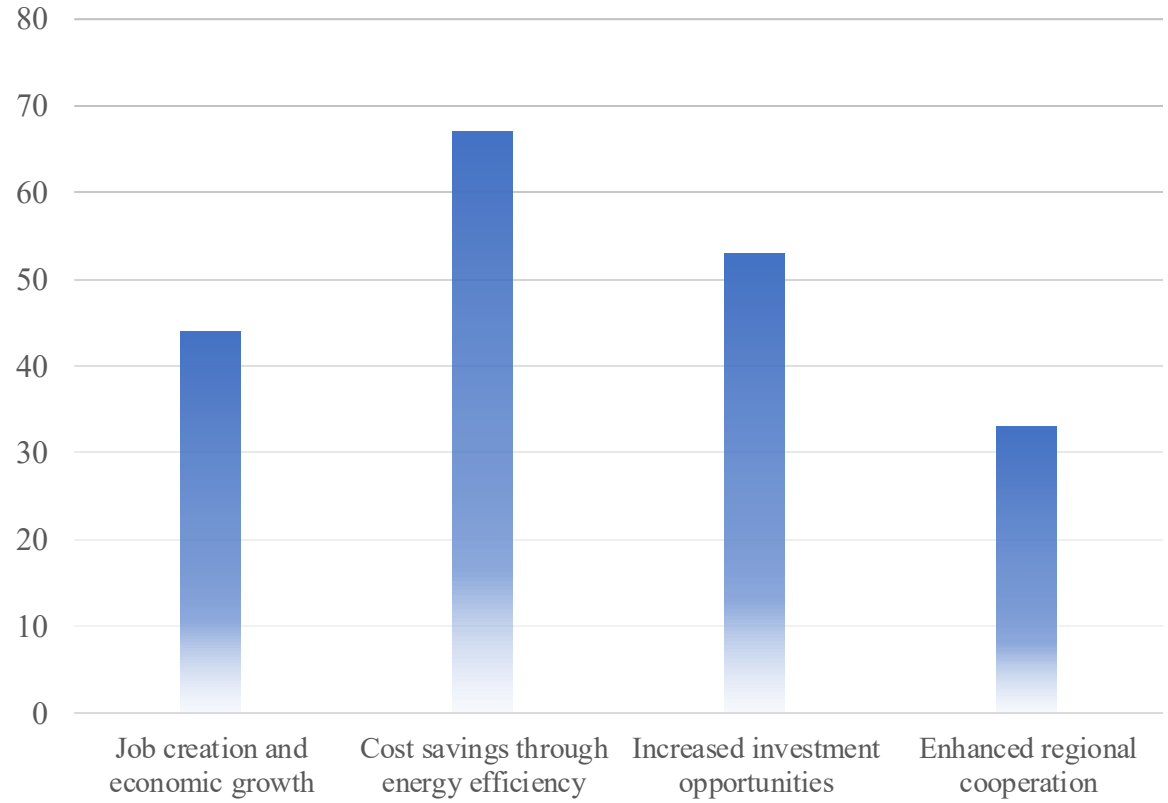


SKILLS AND CAPACITY OF ACTORS TO IMPLEMENT DIGITAL INFRASTRUCTURE AND DECARBONIZATION PROJECTS EFFECTIVELY

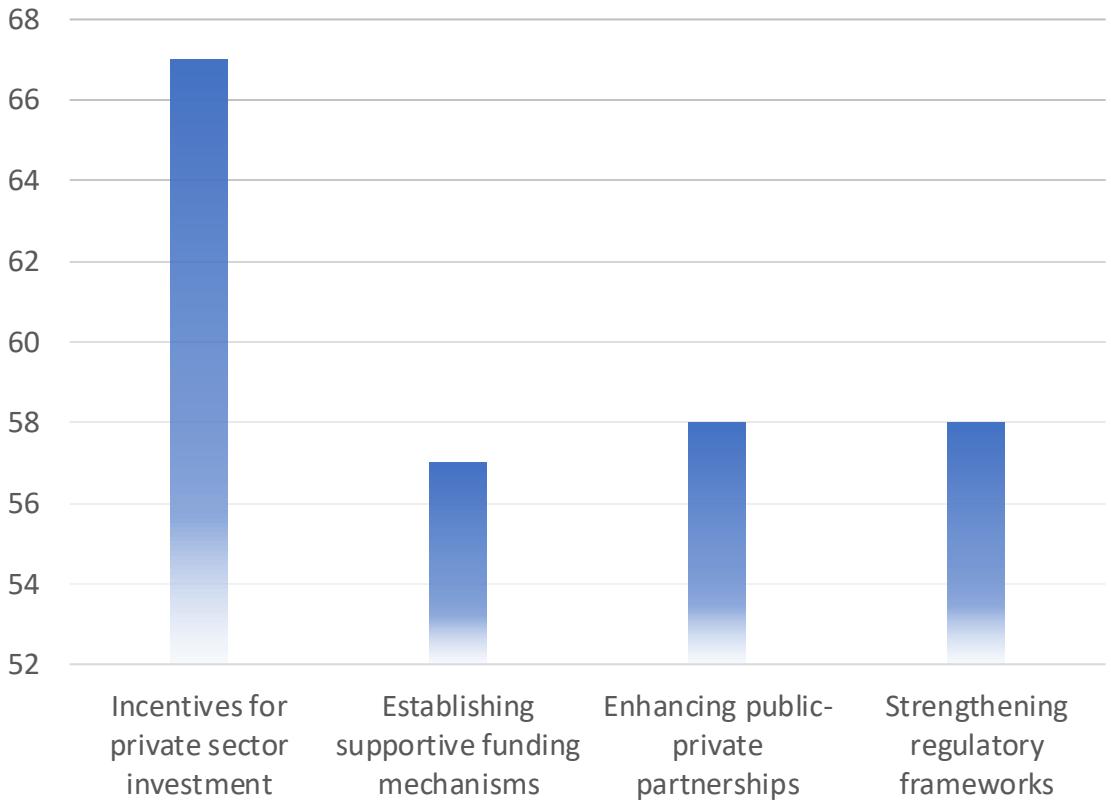
KEY OPPORTUNITIES FOR DIGITALIZING INFRASTRUCTURE AND PROMOTING DECARBONIZATION



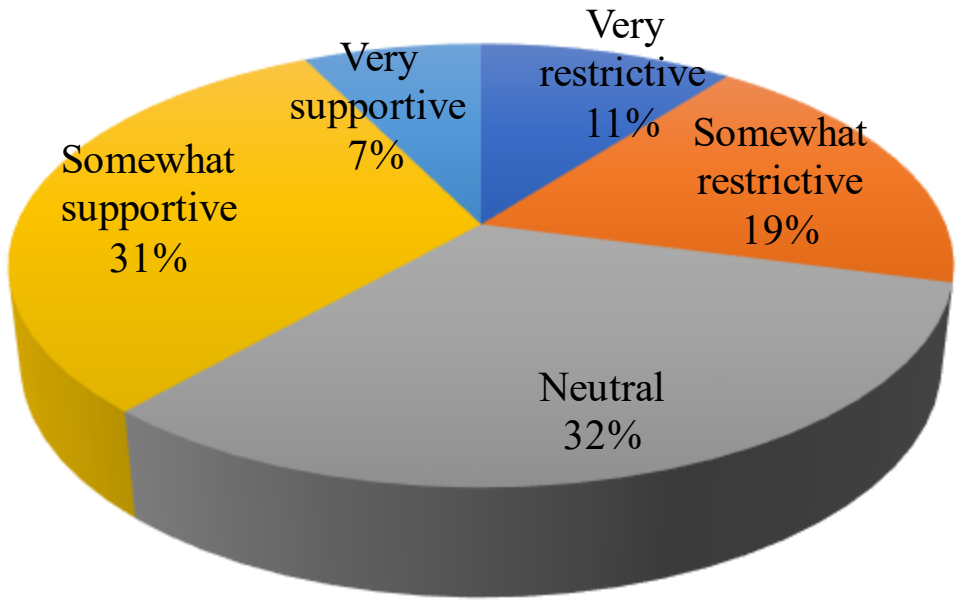
PERCEIVED ECONOMIC BENEFITS OF DIGITALIZING INFRASTRUCTURE AND PROMOTING DECARBONIZATION IN CENTRAL ASIA



POLICY MEASURES FOR PROMOTING DIGITALIZATION OF INFRASTRUCTURE AND DECARBONIZATION.



ASSESSMENT OF EXISTING LEGAL FRAMEWORKS AND REGULATORY POLICIES RELATED TO DIGITALIZATION AND DECARBONIZATION IN CENTRAL ASIA



Econometric Model

- The primary objective of this section is to empirically investigate the nexus between digitalization and decarbonization in Central Asian countries – namely Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.
- Data for this section is obtained from the World Bank Indicators data.
- The dataset follows a panel data structure, consisting of 125 observations across the five Central Asian countries for the 1993-2017 time period.
- This study employs a Panel Autoregressive Distributed Lag (ARDL) model to investigate the long-run and short-run relationship between digitalization and decarbonization in the Central Asian region.
- The ARDL model is commonly used in the literature to estimate the dynamic and long-term impacts of variables on decarbonization (Khan et al., 2022; Shahbaz et al., 2021; Addai et al., 2023; Fauzel, 2017).

$$\Delta LnCO_{2\,i,t} = \beta_0 + \sum_{k=1}^{p-1} \lambda_{ik} \Delta LnCO_{2\,i,t-k} + \sum_{k=0}^{q-1} \sigma_{ik} \Delta DI_{i,t-k} + \sum_{k=0}^{q-1} \alpha_{ik} \Delta C_{i,t-k} + \omega_1 LnCO_{2\,i,t-k} + \omega_2 DI_{i,t-k} + \omega_3 C_{i,t-k} + \varepsilon_{i,t}$$

Variables	Definition	Descriptive Statistics			
		Mean	Max.	Min.	N
CO2 emissions (metric tons per capita)	*Carbon dioxide produced during consumption of solid, liquid and gas fuels, and gas flaring.*	5.5379	15.3411	0.3210	125
Fixed broadband subscriptions (per 100 people)	*Fixed broadband subscriptions pertain to fixed subscriptions that provide high-speed access to the public Internet, excluding subscriptions that solely rely on mobile-cellular networks for data communications. This category encompasses both residential subscriptions and subscriptions intended for organizational use.*	1.1600	14.0657	0.0000	125
Mobile cellular subscriptions (per 100 people)	*These are subscriptions for a public mobile telephone service that grant access to the Public Switched Telephone Network (PSTN) through cellular technology.*	43.9961	176.7856	0.0000	125
Digitalization Index	*Index is calculated based Principal Component Analysis*	1.49E-16	3.4839	-0.9875	125
GDP per capita	*GDP per capita, PPP (constant 2017 international $)*	6652.2530	24862.9700	1134.2310	125
Government expenditure	*General government final consumption expenditure (% of GDP)*	14.2944	37.2613	5.9410	125

Table 1. Variables description. Source: Authors' calculations

Variable	Coefficient	Std. Error	t-Statistic
	LONG RUN EQUATION		
Digitalization Index$_{i,t}$	-0.1217***	0.0208	-5.8293
	SHORT RUN EQUATION		
Error Correction Term$_{t-1}$	-0.4846**	0.2377	-2.0390
$\Delta LnCO_{2_{i,t-1}}$	-0.0083	0.1341	-0.0619
$\Delta LnCO_{2_{i,t-2}}$	-0.0784	0.2046	-0.3832
$\Delta LnCO_{2_{i,t-3}}$	-0.2120	0.1453	-1.4596
ΔDigitalization Index$_{i,t}$	0.0433	0.1005	0.4315
ΔDigitalization Index$_{i,t-1}$	0.1651**	0.0769	2.1479
ΔDigitalization Index$_{i,t-2}$	-0.0204	0.1057	-0.1932
ΔDigitalization Index$_{i,t-3}$	-0.1248	0.1797	-0.6942
Log GPD per capita	0.2621	0.1907	1.3745
Government expenditure	-0.0145	0.0115	-1.2561
Constant	-1.2215	1.9834	-0.6159
Log likelihood	177.0952		
Included observations	105		
Selected Model	ARDL(4, 4)		

Table 2. Panel ARDL estimates for CO2 emissions per capita. Note: *p < 0.10, ** p < 0.05, *** p < 0.010. Source: Authors' calculations

Conclusion and policy recommendations

- The countries of Central Asia recognize the importance of digitalization and decarbonization in their infrastructure development. These efforts hold numerous advantages, primarily enhancing the efficiency of their economies in terms of resource utilization and productivity.
- By adopting digital technologies, these countries can streamline processes, optimize resource allocation, and minimize waste, leading to a more sustainable and resource-efficient economy. Moreover, digitalization aligns with their international commitments to address climate change, showcasing their dedication to global environmental goals.

- **Policy recommendations for promoting the digitalization and decarbonization of infrastructure in Central Asia.**
  - **Establish a Policy Framework for Digitalization and Decarbonization.** Develop policy framework that includes specific targets, incentives, and regulations to encourage investments in digital infrastructure, renewable energy, energy efficiency, and the adoption of smart technologies across sectors.
  - **Promote Renewable Energy Deployment.** Policymakers should establish favourable regulatory frameworks, feed-in tariffs, and tax incentives to attract private investments in renewable energy projects.
  - **Foster Digital Infrastructure Development.** Efforts should be directed towards expanding digital infrastructure, including broadband connectivity and data centres, across Central Asia.
  - **Strengthen Digital Skills and Entrepreneurship.** Central Asian governments should prioritize the development of digital skills and entrepreneurship to enable the region's workforce to fully participate in the digital economy.

- **Thank you for your attention!**

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