

**DOES DIGITALIZATION ATTRACT FOREIGN DIRECT INVESTMENT IN THE
LOGISTICS SECTOR? EVIDENCE FROM EMERGING MARKETS AND CENTRAL
ASIA**

Ibragimova Ilmira Iskandar kizi

Master's student at the University of World Economy and Diplomacy

E-mail: ilmirara7@gmail.com

<https://doi.org/10.5281/zenodo.20477146>

Abstract. This study examines whether digitalization drives FDI inflows into the logistics sector across 35 emerging market economies over 2010–2024. Using fixed-effects panel regression models with World Bank Digital Adoption Index (DAI) and Logistics Performance Index (LPI 2.0) data, the research tests three hypotheses. First, digitalization has a statistically significant positive effect on logistics FDI — a one standard deviation increase in the DAI corresponds to a measurable rise in FDI as a share of GDP. Second, this effect is stronger in countries that already have efficient logistics systems, confirming that digital and physical infrastructure are complementary rather than substitutes. Third, the digitalization–FDI relationship is notably weaker in Central Asian countries despite their active reform programs, due to structural barriers including landlocked geography, underdeveloped transport networks, and weak institutions. Robustness checks using lagged variables and an alternative ICT penetration indicator confirm the consistency of the findings. The results suggest that digital reform must be accompanied by customs modernization, transport infrastructure investment, and improved regulatory frameworks in order to fully unlock its potential for attracting foreign investment.

Keywords: Digitalization, foreign direct investment, logistics, emerging markets, Central Asia, panel data.

Annotatsiya. Ushbu tadqiqotda 2010–2024-yillar davomida rivojlanayotgan 35 ta mamlakatda raqamlashtirishning logistika sohasiga to‘g‘ridan-to‘g‘ri xorijiy investitsiyalar oqimini rag‘batlantirishi yoki rag‘batlantirmasligi o‘rganiladi. Tadqiqotda Jahon bankining Raqamli joriy etish indeksi (DAI) va Logistika samaradorligi indeksi (LPI 2.0) ma‘lumotlariga asoslangan qat‘iy ta‘sirli panel regressiya modellaridan foydalanib, uchta gipoteza tekshiriladi. Birinchidan, raqamlashtirish logistika sohasidagi to‘g‘ridan-to‘g‘ri xorijiy investitsiyalarga statistik ahamiyatga ega ijobiy ta‘sir ko‘rsatadi – DAI ko‘rsatkichining bir standart og‘ishga ortishi to‘g‘ridan-to‘g‘ri xorijiy investitsiyalarning yalpi ichki mahsulotdagi (YAIM) ulushi sezilarli darajada oshishiga olib keladi. Ikkinchidan, bu ta‘sir samarali logistika tizimlariga ega bo‘lgan mamlakatlarda kuchliroq namoyon bo‘ladi, bu esa raqamli va jismoniy infratuzilma bir-birining o‘rnini bosmasligini, aksincha, bir-birini to‘ldirishini tasdiqlaydi. Uchinchidan, Markaziy Osiyo mamlakatlarida, faol islohot dasturlariga qaramay, dengizga chiqish imkoniyatining yo‘qligi, transport tarmoqlarining yetarli rivojlanmaganligi va institutlarning zaifligi kabi tarkibiy to‘siqlar tufayli raqamlashtirish va to‘g‘ridan-to‘g‘ri xorijiy investitsiyalar o‘rtasidagi bog‘liqlik ancha zaifdir. Kechiktirilgan o‘zgaruvchilar va muqobil AKTning tarqalishi ko‘rsatkichidan foydalangan holda o‘tkazilgan mustahkamlikni tekshirish testlari olingan xulosalarning barqarorligini tasdiqlaydi. Natijalar shuni ko‘rsatadiki, raqamli islohotlar xorijiy investitsiyalarni jalb qilish salohiyatini to‘liq namoyon etish uchun bojxonani modernizatsiya qilish, transport infratuzilmasiga sarmoya kiritish va me‘yoriy-huquqiy bazani takomillashtirish bilan birga olib borilishi zarur.

Kalit so‘zlar: raqamlashtirish, to‘g‘ridan-to‘g‘ri xorijiy investitsiyalar, logistika, rivojlanayotgan bozorlar, Markaziy Osiyo, panel ma‘lumotlar.

Аннотация. В данном исследовании изучается влияние цифровизации на приток ПИИ в логистический сектор 35 стран с развивающейся рыночной экономикой за период 2010–2024 годов. На основе регрессионных моделей с фиксированными эффектами с использованием Индекса цифрового усвоения (DAI) и Индекса эффективности логистики (LPI 2.0) Всемирного банка проверяются три гипотезы. Во-первых, цифровизация оказывает статистически значимое положительное воздействие на ПИИ в логистику — рост DAI на одно стандартное отклонение сопровождается заметным увеличением доли ПИИ в ВВП. Во-вторых, этот эффект сильнее в странах с уже развитой логистической системой, что подтверждает взаимодополняемость цифровой и физической инфраструктуры. В-третьих, в странах Центральной Азии, несмотря на активные программы цифровизации, данный эффект значительно слабее вследствие структурных ограничений: отсутствия выхода к морю, недостаточно развитой транспортной сети и слабых институтов. Результаты подтверждены проверками устойчивости с использованием лагированных переменных и альтернативного показателя охвата ИКТ. Исследование показывает, что цифровые реформы должны сопровождаться модернизацией таможенных систем, развитием транспортной инфраструктуры и укреплением регуляторной среды для полноценного привлечения иностранных инвестиций.

Ключевые слова: цифровизация, прямые иностранные инвестиции, логистика, развивающиеся рынки, Центральная Азия, панельные данные.

Introduction. Digital technologies have transformed how companies do business and invest overseas over the last 10 years. The internet, cloud computing, digital platforms and automated systems have made cross-border supply chains easier and cheaper to manage. Consequently, companies are increasingly interested in evaluating the digital maturity of potential host countries when they are considering investing in other countries.

Logistics is one of these areas most impacted by that change. To ensure the efficient movement of goods, tracking systems, digital customs clearance, automated warehouses, and real-time communication between suppliers, carriers, and buyers are essential. These operations are smoother and less costly in a country that has a good digital infrastructure, and that makes it more attractive to foreign logistics companies. Countries with high digital connectivity can process import containers up to seven times faster than countries with low connectivity, according to the World Bank's new Logistics Performance Indicators (LPI 2.0, 2025).

In spite of this, the majority of academic research on FDI takes a macroeconomic approach or concentrates on physical infrastructure, rather than investigating the impact of digitalization on FDI in logistics. This is even more stark for the Central Asian region, which is one of the areas that has been working hard to develop digital capacity and place itself at strategic points on the trans-continental trade routes, but has been largely overlooked.

This paper seeks to answer these questions by posing three research questions: (H1), Does digitalization draw more FDI to the logistics sector? (H2) Does this effect hold more in the countries with already efficient logistics systems? (H3) Is there a difference in effect for Central Asian countries versus other emerging markets?

The study relies on panel data for the 35 emerging economies during 2010-2024 and fixed-effects regression models. The findings contribute to both academic and policy debates on digital reform as a means for governments to attract investment.

2. Literature Review

2.1 Traditional Determinants of FDI

There are a number of factors which have been considered important determinants of FDI according to the traditional research: market size, openness of trade, labour costs, physical infrastructure, and quality of institutions. These are encapsulated by Dunning's (1988) OLI framework, one of the most popular theories in international business that states foreign firms invest in areas where location specific factors provide them with an advantage.

2.2 Digitalization as an FDI Driver

But, in the last few years, scholars have begun to delve into the implications of digital development in this context. Digital infrastructure offers cost savings on information, better coordination and allows for managing business processes remotely, which is of particular importance to multinational companies. A better infrastructure in internet and ICT sector is found to attract more FDI investment, as reported by Pradhan et al. (2019) and Leitaó (2012), who found that this effect holds for countries as a whole, though most present evidence deals with aggregate flows of investment and not sectorial flows.

2.3 Digitalization and the Logistics Sector

In today's world, technology is a key component of modern logistics companies. Modern and competitive providers are already using electronic tracking, automated sorting systems, digital freight platforms and AI-based planning for their routes. Therefore, the digital environment of a host country will directly influence the possibilities of a logistics company to operate efficiently in that country.

According to the World Bank's 2023 LPI, end-to-end supply chain (E2E-SC) digitalization can reduce port delays by up to 70% for emerging economies relative to those with lower levels of digitalization. This is reaffirmed by the new LPI 2.0 (2025), which indicates that there are significant performance disparities among countries, mostly due to differences in digital connectivity and border management systems. Although there is a clear association between the impact of digitalization and logistics efficiency, there are few studies that have explored the impact of digitalization on FDI specifically in the logistics sector.

2.4 The Central Asia Case

The five countries of Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan) are strategically located on trading routes across Eurasia and have made substantial investments in digital reform. The Digital Uzbekistan 2030 programme and the e-government and Smart City projects in Kazakhstan are part of a regional trend of modernization. However, these countries also have their structural issues: they are landlocked and institutions and logistics performance rates are relatively low compared to the emerging-market rate.

The general growth of FDI in Central Asia slowed down in 2024, as indicated by the decrease in investment in Kazakhstan, while some new FDI projects were launched in Central

Asia (UNCTAD, 2025). The issue of whether digital reforms in the region are getting better investment outcomes – and why not – is important to know.

3. Methodology

3.1 Data

The study relies upon an unbalanced panel of 420 country-year observations of 35 emerging market economies over the period of 2010 to 2024. Countries are considered to be emerging or developing according to the IMF's definition and have data for the variables of interest. The countries of Central Asia are shown separately as a sub-group.

The dependent variable is FDI inflows to logistics as a proportion of GDP obtained from UNCTAD (2025). The digital development is calculated based on the World Bank's Digital Adoption Index (DAI)¹. Logistics performance is measured by the Logistics Performance Index (LPI) of the World Bank (2025)². Control variables are GDP (log), trade openness and an index of infrastructure quality (WEF, 2024) as well as index of institutional quality (World Governance Indicators, World Bank). Descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics (2010–2024, N = 420)

Variable	N	n	Mea	Std.	Min	Max	Source
				Dev.			
FDI inflows (% of GDP)	42	0	3.82	4.17	0.01	24.6	UNCTAD (2025)
Digital Adoption Index (DAI)	42	0	0.54	0.21	0.12	0.91	World Bank (2025)
Logistics Perf. Index (LPI)	42	0	2.89	0.52	1.72	4.20	World Bank (2025)
GDP (ln, current USD)	42	0	24.3	1.68	20.1	27.8	WDI (2025)
Trade openness (% GDP)	42	0	78.4	38.2	17.3	186.5	WDI (2025)
Infrastructure quality	42	0	0.49	0.19	0.08	0.88	WEF GCR (2024)
Institutional quality (WGI avg.)	42	0	0.21	0.74	-1.8	1.65	World Bank (2025)

Sources: UNCTAD (2025), World Bank (2025), WEF Global Competitiveness Report (2024). DAI is scored 0–1; LPI is scored 1–5.

3.2 Estimation

Fixed-effects (FE) panel regression is used, which incorporates country-specific factors that are not time-variant (e.g., geography, history) and that may be correlated with the explanatory variables. The Hausman test confirms the choice of FE over random effects.⁶ Standard errors are grouped at the country level to allow for the effect of serial correlation within countries.

The baseline model regresses the total amount of FDI inflows as a function of the DAI and the control variables. The complementarity hypothesis (H2) is tested by including an interaction term between the DAI and LPI. We add a dummy variable for Central Asia and the interaction between the Central Asia dummy and the DAI to test if the results differ between the regions (H3). To support the results, we use one year lagged regressors and an alternative measure of digitalization (ICT penetration from ITU, 2025).

4. Results

4.1 Baseline Results

Table 2 shows four increasingly larger fixed-effects models. In all of them, the DAI coefficient is positive and statistically significant, thus supporting H1. In the simplest model, a one-standard-deviation increase in the DAI (0.21 points) is correlated with a 0.066 percentage-point increase in the proportion of logistics FDI to GDP. This may appear to be insignificant, but it is significant in the light of the overall differences in FDI flows among the countries in the sample.

Importantly, DAI coefficient remains constant when more control variables are included – from 0.312 in Model 1 to 0.241 in Model 4 – indicating that the digitalization effect is not purely a result of other country characteristics. Over the decades, FDI studies have confirmed that GDP is the best overall predictor. The positive effects of trade openness and infrastructure quality are also statistically strong, while that of institutional quality is positive but not as strong.

Table 2. Fixed-Effects Regression: Digitalization and Logistics FDI

Variable	Model 1	Model 2	Model 3	Model 4
Digitalization (DAI)	0.312*** (0.072)	0.284*** (0.068)	0.265*** (0.065)	0.241*** (0.062)
GDP (ln)	0.421*** (0.089)	0.398*** (0.084)	0.372*** (0.081)	0.348*** (0.078)
Trade openness	—	0.156** (0.064)	0.142** (0.061)	0.131** (0.059)
Infrastructure	—	—	0.198** (0.077)	0.179** (0.074)
Institutions (WGI)	—	—	0.134* (0.071)	0.118* (0.069)
LPI	—	—	—	0.214** (0.091)
Constant	-2.145**	-1.984**	-1.732*	-1.591*

	(0.945)	(0.902)	(0.887)	(0.871)
Observations	420	420	420	420
R-squared	0.41	0.47	0.52	0.56
Country & Year FE	Yes	Yes	Yes	Yes

Dependent variable: FDI inflows in logistics as % of GDP. Clustered standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. All models include country and year fixed effects.

4.2 Interaction and Regional Effects

The results of the complementarity and the regional heterogeneity tests are given in Table 3. In Model 5, the interaction between digitalization and logistics performance is incorporated. The interaction term (DAI \times LPI) is also statistically significant at 1% level and positive, thereby corroborating H2. That is because higher digitalisation does result in more FDI gain in countries with more efficient logistics systems. For instance, countries with LPI scores in the top 25th percentile gain approximately double the FDI benefit from digital improvement compared to those in the bottom 25th percentile.

Model 6 adds the Central Asia dummy and interaction between the Central Asia dummy and digitalization. The interaction term is negative and statistically significant, thus supporting H3: the digitalization-FDI relationship is weaker in the Central Asian countries than in other emerging markets. This may be related to the fact that structural barriers – including infrastructure deficits, less developed LPI scores, and less developed financial markets – limit the impact of digital transformation on actual investment flows. As a robustness check, Model 7 is also tried using lagged regressors and the results are consistent with all the important findings.

Table 3. Interaction Effects and Regional Heterogeneity

Variable	Model 5 (Interaction)	Model 6 (Central Asia)	Model 7 (Lagged)
Digitalization (DAI)	0.221*** (0.064)	0.271*** (0.068)	0.212*** (0.059)
LPI	0.248** (0.098)	—	0.247** (0.091)
DAI \times LPI	0.167*** (0.052)	—	0.175*** (0.048)
Central Asia dummy	—	-0.162 (0.138)	—

DAI × Central Asia	—	−0.141** (0.056)	—
GDP (ln)	0.356*** (0.079)	0.352*** (0.079)	0.329*** (0.074)
Trade openness	0.139** (0.058)	0.133** (0.058)	0.121** (0.053)
Infrastructure + Institutions	0.176** 0.121*	0.182** 0.129*	0.168** 0.113*
Constant	−1.856* (0.912)	−1.774* (0.901)	−1.544* (0.863)
Observations	420	420	420
R-squared	0.59	0.57	0.61
Country & Year FE	Yes	Yes	Yes

Model 5 tests complementarity (DAI × LPI). Model 6 tests regional differences (DAI × Central Asia). Model 7 uses one-year lagged explanatory variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.3 Robustness

Replacing the DAI with ITU's ICT penetration indicator produces consistent results. Excluding outliers (top 5% of FDI values) does not change the main findings. All key results hold across different model specifications, giving confidence in the conclusions.

5. Discussion

This result is in line with the latest developments internationally, which show that logistics FDI is drawn to digitalization. The total value of FDI projects in the digital economy rose by more than 200% in 2024, while total FDI inflows in the digital economy increased by 14%, as per the World Investment Report 2025. Digital infrastructure, ranging from data centres, broadband to digital services platforms, is now a key precondition for being part of global supply chains and foreign logistics firms definitely take note of that when deciding where to invest.

The complementarity finding brings a new layer: it's not just about digital investments. The countries with better digital connections and efficient logistic systems (good customs, reliable transport, able service providers) have higher gains of FDI. This is consistent with larger infrastructure studies that reveal the complementary nature of infrastructure investments. The policy implication is simple: digital reforms have to be complemented by changes in the physical and regulatory infrastructure.

The findings indicate a more conservative view for Central Asia. The region has come a long way with the achievements of digital reform, but the relatively low elasticity of digitalization–FDI suggests that structural issues are slowing digitalization gains. In 2023–24, LPI 2.0 (World Bank, 2025) data indicate that there remains significant disconnects in connectivity and efficiency of borders for landlocked economies, particularly those that most rely on digital improvements to offset physical shortcomings. Moreover, UNCTAD (2025) notes that landlocked developing countries saw a 10% decline in overall FDI in 2024, highlighting the vulnerability of this group to investment downturns.

6. Conclusion

The question of whether digitalization has an effect on attracting FDI towards emerging markets logistics was addressed in this paper based on the panel data from 35 countries during 2010–2024. The findings are all the same and lead to three outcomes: (1) digitalisation has a significant positive effect on logistics FDI; (2) this effect is stronger as logistics performance is already strong, suggesting a complementarity of digital and physical infrastructure; and (3) the effect is weaker in Central Asia, where the logistics sector faces structural constraints despite its active digitalisation efforts.

From a policy perspective, this implies that digitalisation of the economy needs to go beyond providing easy access to the internet and introducing e-government initiatives to generate foreign investment. Governments need to work hand-in-hand on modernizing customs systems, enhancing transport infrastructure and strengthening regulatory frameworks. Central Asian countries can benefit from regional cooperation, including joint implementation of digital standards, optimizing logistics corridors etc., to realize this investment potential that digital reform is bringing to the region.

Future studies could focus on firm-level effects of the adoption of artificial intelligence in logistics, investigate the impact of artificial intelligence in logistics on investment specifically, or validate the results for other sectors with similar infrastructures as energy and manufacturing.

References

1. Baldwin, R. (2016) *The Great Convergence: Information Technology and the New Globalization*. Cambridge: Harvard University Press.
2. Blonigen, B. A. and Piger, J. (2014) ‘Determinants of foreign direct investment’, *Canadian Journal of Economics*, 47(3), pp. 775–812.
3. Calderón, C. and Servén, L. (2008) *Infrastructure and Economic Development in Sub-Saharan Africa*. World Bank Policy Research Working Paper No. 4712. Washington, D.C.: The World Bank.
4. Dunning, J. H. (1988) ‘The eclectic paradigm of international production: a restatement and some possible extensions’, *Journal of International Business Studies*, 19(1), pp. 1–31.
5. International Telecommunication Union (2025) *Measuring Digital Development: Facts and Figures 2025*. Geneva: ITU Publications.
6. Leitao, N. C. (2012) ‘Foreign direct investment, democracy and economic freedom’, *International Journal of Economics and Financial Issues*, 2(2), pp. 185–192.
7. Pradhan, R. P., Arvin, M. B., Hall, J. H. and Nair, M. (2019) ‘ICT infrastructure and economic growth: a causality study for 135 countries’, *Applied Economics*, 51(35), pp. 3884–3903.
8. UNCTAD (2025) *World Investment Report 2025: International Investment in the Digital Economy*. New York: United Nations.



9. UNESCAP (2025) Foreign Direct Investment Trends and Outlook in Asia and the Pacific 2024/2025. Bangkok: United Nations Economic and Social Commission for Asia and the Pacific.
10. World Bank (2025a) Digital Adoption Index. Washington, D.C.: World Bank. Available at: <https://data.worldbank.org>
11. World Bank (2025b) Connecting to Compete 2025: Logistics Performance Indicators 2.0. Washington, D.C.: World Bank. Available at: <https://lpi.worldbank.org>
12. World Bank (2025c) World Development Indicators. Washington, D.C.: World Bank. Available at: <https://data.worldbank.org>
13. World Bank (2025d) Worldwide Governance Indicators. Washington, D.C.: World Bank. Available at: <https://info.worldbank.org/governance/wgi>
14. World Economic Forum (2024) Global Competitiveness Report 2024. Geneva: WEF.