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# Development of foreign trade activities of regions in the conditions of digitalization of international trade

**Graduation Qualification Work** for obtaining a bachelor's degree in the direction 5233500 "International Economics and Management (by region and area of activity)"

**The work has been reviewed and recommended for defense:**

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# INTRODUCTION

**Relevance.** In the digital economy, information and communications technology (ICT) has transformed how society and businesses operate, with the highest data storage and processing capacity in history. Due to a series of market shifts brought about by this, nations worldwide are starting to recognize that digitalization in trade will present both new opportunities and challenges. In the earliest stages of the "fourth industrial revolution," improving national competitiveness through digitalization and data security protection is an important topic that has gained attention in the international community today. On February 9th, 2023, the government of Uzbekistan launched[1] an e-commerce strategy dedicated to developing the e-commerce sector between 2023-2027. According to the report, the strategy will assist the digital economy over the next five years and identify key initiatives to create an enabling e-commerce environment for businesses, such as capacity and talent development for effective digital transformation. Besides, At the "Central Asia-China" summit, the head of state, Shavkat Mirziyoyev, put forward the initiative to form a new economic dialogue and strengthen economic relations to double the trade volume of Uzbekistan's regions with China by 2030. It was proposed to realize this task by increasing the mutual supply of industrial and agricultural products, establishing an effective trade-logistics infrastructure and modern supply-chain networks, "green" and express lanes, and common platforms for e-commerce.

In light of these significant national initiatives, the relevance of our study becomes evident. It underscores the critical need for a theoretical and methodological framework to justify developing foreign trade activities in digitalized international trade. The ongoing digital transformation has the potential to impact every element of a country's economy, including how enterprises and regions engage in international trade. Investigating these

[1] Daryo.uz. (2023). Uzbekistan launches national e-commerce strategy to build successful ecosystem. [online] Available at: https://daryo.uz/en/2023/02/09/uzbekistan-launches-national-e-commerce-strategy-to-build-successful-ecosystem.

dynamics is essential for providing insights that can guide good decision-making and policies in response to the changing digital world.

Foreign and domestic scientists are actively studying digitalization's impact on the global economy's development. According to OECD[2] report in 2023, a 1% increase in digital connectivity leads to a 0.3% reduction in domestic and international trade costs, resulting in a double dividend[3]. Additionally, MSMEs in developed and developing nations can benefit from the automation of border operations by increasing the value of their imports and exports by 4.5% to 6.5% and participating in international trade [3].

The collaborative study project of S. Kraus, P. Jones, N. Cuyler, A. Weinmann, N. Chaparro-Banegas, and N. Roig-Tierno goes into great detail about issues related to the digital transformation of business processes of firms and organizations. Furthermore, national scientists' research is devoted to increasing the competitiveness of the Republic of Uzbekistan's national economy in the digital economy, improving the theoretical and practical aspects of the digital economy, and introducing digital technologies in public administration. One of them is "Actual issues of digitalization in the industrial sector of the economy of Uzbekistan" by Konstantin Kurpayanidi, which explores the problems of digitalization in Uzbekistan's industrial sector, emphasizing the relevance of digitalization in establishing a knowledge-based economy and attaining measurable economic results. It highlights successful businesses as good examples of digital transformation and advocates for applying digital economy tools to improve efficiency, productivity, and global competitiveness. The findings can be used to guide and enhance the country's digitalization efforts.

**Purpose of this research**. This research aims to investigate the assessment and impact of digitalization on foreign trade activities of regions. Through comprehensive analysis of current trends, evaluation of existing approaches, and examination of international best practices, the research will make practical

[2] Organisation for Economic Co-operation and Development

[3] OECD (2023). Key issues in Digital Trade OECD Global Forum on Trade 2023 ‘Making Digital Trade Work for All’. [online] Available at: https://www.oecd.org/trade/OECD-key-issues-in-digital-trade.pdf.

recommendations to maximize the participation of regions in global digital trade and contribute to Uzbekistan's broader economic integration.

To achieve research purpose, the following tasks were put forward:

- Examine existing theoretical foundations related to the development of foreign trade activities in regions within the context of digitalization
- Examine different methods to evaluate the degree of digitalization of regions, providing an accurate insight of the digitization environment.
- Evaluate the impact of the digitalization of international trade on the development of foreign trade activities in regions.
- Draw insights from foreign experience on the development of digitalization
- Analyze Uzbekistan's integration policy into the global economy in the context of digitalization.
- Identify and propose future strategies to improve the effectiveness of international trade activities across the country in the conditions of digitalization.

**The object of the study** is the foreign trade activities of regions.

**The subject of the study** involves the digitalization conditions of regions and its impact on international trade.

**Methodology.** This study relies on the expertise of leading international experts in foreign trade and digitalization for assessing the impact of digitalization on regional foreign trade activities. And, it explores the complex relationship between digitalization and regional trade using, historical data analysis, and a variety of analytical techniques, such as statistical data analysis, correlation-regression analysis, econometric models.

**Structure and scope of work.** This work is divided into three chapters and nine subchapters. The theoretical mechanisms and approaches are discussed in the first chapter. The second chapter includes econometric models and descriptions of the variables and methodologies that are used in the work of other scholars. The third chapter gives the findings from the empirical analyses, which include the principal

component and panel data analysis, regional heterogeneity test. Finally, at the end, the conclusion and references are included.

# CHAPTER I. THEORETICAL FOUNDATIONS OF THE DEVELOPMENT OF FOREIGN TRADE ACTIVITIES IN THE CONTEXT OF DIGITALIZATION OF INTERNATIONAL TRADE

## 1.1 The role and importance of international trade in the context of international economic relations

International trade is a major force in economic progress. International trade is a branch of international economic relations that consists of all countries' foreign trade in goods, services, and products of intellectual labour. It now accounts for 80% of all foreign relations. In order to participate in international trade, a nation must engage in foreign trade, or trade between nations. This trade consists of two inbound flows of products and services export and import. Subjects of international trade are:

- World countries
- TNCs and MNCs
- Regional integration groups

The place of international trade in the system of international economic relations is established by the fact that:

- It realises the advantages of all forms of global economic relations, including capital export, production collaboration, and scientific and technological cooperation;
- International trade development is an important prerequisite for regional integration and contributes to the further deepening of the international division of labour;
- It stimulates foreign investment and international payments processes[4].

[4] mydocx.ru. (n.d.). The essence and role of international trade in the system of international economic relations. Theories of international trade. [online] Available at: https://mydocx.ru/4-51199.html.

The various national economies in the modern world are becoming mutually dependent today. It is difficult to find an example of a closed economy. Almost every country uses open economy policy at some degree. Because, no country in the modern world is completely self-sufficient. This underscores the necessity for international trade. According to David Ricardo's theory, the development of international trade based on the international division of labor, leads to increased efficiency due to increased volumes, products and services range, and openness of national economies. This allows countries to consume goods and services more cheaply and obtain resources and products from other countries that domestic producers cannot supply, such as rare raw materials or high-tech products. A 2019 OECD study found that imported goods were 10% cheaper than domestically produced equivalents, indicating significant cost savings for consumers. The World Bank data shows a surge in unique tradable goods, from 5,000 in 1962 to over 180,000 in 2017, ensuring access to rare minerals and cutting-edge technology. Imported goods is crucial for countries with limited natural resources, as seen in Japan, where nearly 100% of its oil and copper are imported.

Integration into the global economy has proven to be an effective for countries to promote economic growth, development, and poverty reduction. Over the last two decades, global trade has grown at a rate twice as fast as global output. However, trade has long been a driver of growth. The world trading system has benefited from eight rounds of multilateral trade liberalisation, since 1947, when the General Agreement on Tariffs and Trade (GATT) was established. Indeed, the final of these eight rounds (the so-called "Uruguay Round" completed in 1994) resulted in the establishment of the World Trade Organisation to help administer the growing body of multilateral trade agreements. As a result, living standards have increased globally in the global economy. This prosperity has been shared by the majority of developing nations; in some countries, incomes have increased significantly. Compared to the early 1970s, developing countries accounted for about a quarter of global trade; today, as a group, they account for one-third of it.

Compared to traditional product exports, many developing countries have significantly increased their manufacturing and service exports; manufacturing now accounts for 80% of exports from developing nations. Furthermore, 40 percent of exports from developing nations now go to other developing nations as a result of the rapid growth in trade between them. Many developing Asian and Latin American nations have made extremely impressive progress. Due to their decision to engage in international trade, these nations have prospered and have drawn the majority of foreign direct investment into developing nations. This is true for higher-income Asian nations like Korea and Singapore, who were themselves struggling until the 1970s, as well as China and India.

In addition to the advantages of world trade to developing countries, there are also advantages that accrue to more developed and competitive countries that focus their national specialization on high-tech complex products that provide the highest level of value added in their production. Developed countries with higher scientific and technological potential seek to secure the stage of research and development in the international division of labor and dump further production replication of innovations in less developed countries. They actively invest in the development of these industries in developing countries, including through the transfer of new technologies, materials and components. This policy allows them to use cheaper resources and labor of developing countries, as well as the advantages of relatively low taxes and environmental payments inherent in most of them. At the same time, the production and export of industrial products, including complex and high-tech products, are increasing in developing countries, which entails better terms of trade.

## 1.2 The impact of the main trends in the development of the world economy on international trade

Today, digital globalization, defined primarily by data and information flows, is becoming new type of globalization. It affects how business is conducted across borders, the flow of economic benefits, and the expansion of participation.

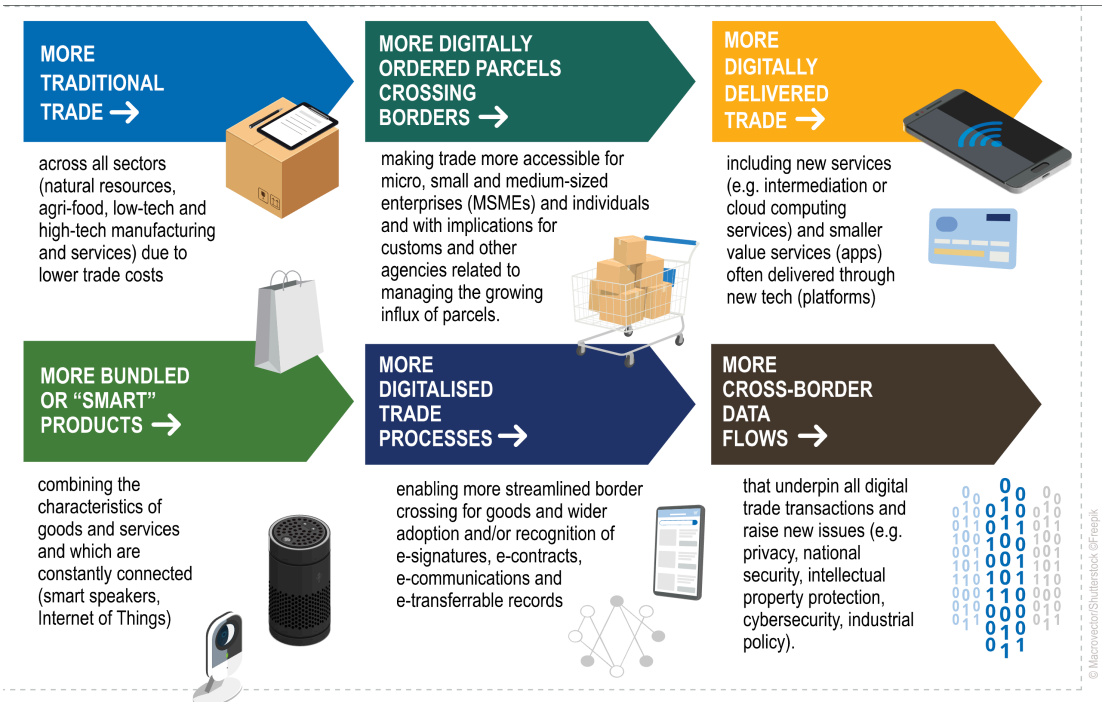
Globalisation refers to the increasing interconnection of the world's economies, cultures, and populations as a result of cross-border trade in goods and services, technology, and investment, people, and information flows (Kolb, 2008). Countries have formed economic alliances to facilitate these movements for centuries. The first phase of modern globalisation began with an increase in world trade beginning around 1850, owing primarily to European conquests of parts of the globe that yielded valuable natural resources and fueled trade and investment between European imperial powers, their colonies, and the United States. The term resurfaced in the early 1990s, following the Cold War, as cooperative arrangements shaped modern life. Consequently, there has never been more interdependence in the world economy. According to the World Bank (2020), trade as a percentage of global GDP was 27% in 1970; by 2018, it had risen to 59%. The rise was caused by a steady increase in international trade in goods and services. Furthermore, in this globalised world, emerging economies account for more than half of global trade flows.

The Covid-19 pandemic has caused a significant shift in the direction of globalization towards digitalization among businesses, consumers, governments, investments, and trade. Digital globalisation is a type of globalisation in which the digital transformation of economies alters consumption, commerce, investment, business operations, and government administration. It transforms the economic and trade relations between countries. Data and information are the new fundamental resources, serving as the "new oil." The more data and information collected, the better solutions that use artificial intelligence (AI) (i.e. machine learning-based solutions) become. Global inflows and outflows of data, ideas, technologies, talent, and best practices also have an impact on investment decisions. All of this translates into data monetization opportunities. In the public sector, the digital revolution presents substantial opportunity for all levels of government to improve the delivery of public goods and services while also raising more and better revenue. Digital transformation is no longer an option in the private sector. It is now required for all businesses, large, medium, and small.

Companies must be able to reinvent themselves, fundamentally modifying their models and processes with an approach involving significant changes in technology, culture, operations, and value creation. As they expand across borders, many businesses become increasingly complex and inefficient. Digital technologies have the potential to reduce complexity and provide leaner models for going global. Companies are also being pushed to reconsider their organisational structures, goods, assets, and competitors as a result of digital globalisation. Digital globalisation benefits both large businesses and small and medium-sized organisations (SMEs). SMEs are connecting with clients and suppliers in other countries through digital platforms (e.g., eBay, Amazon, Facebook, and Alibaba). Digital platforms transform the economics of doing business across borders by lowering the cost of international interactions and transactions. They facilitate the development of more efficient, transparent markets and consumer groups on a global scale. This provides businesses with an extensive base of potential clients as well as efficient methods of reaching them. Individuals are utilising global internet platforms to learn, find work, display talent, and expand their personal networks. On social media, more than three billion people have international relationships. As a result, digital platforms are critical in this new era of globalisation. Despite its advantages, digital globalisation presents a number of challenges. Companies can enter new markets, but they face pricing constraints, aggressive global competition, and disruptive digital business models. Data must be secured from cybercrime. Many of these concerns will necessitate greater international cooperation. Globalisation in the modern era is complex and fast-paced. However, the interconnectedness may lead to growth (McKinsey Global Institute, 2016).

Another key part of the digital economy and digital globalisation is e-commerce. According to the WTO, electronic commerce is the sale or purchase of goods or services carried out over computer networks using methods specifically designed to receive or place orders. Although goods or services are ordered electronically, payment and final delivery of goods or services do not

necessarily have to be completed online. The most important component of e-commerce is cross-border e-commerce, which over the past few years has become an integral part of the global trade. There are currently between 12 and 24 million e-commerce sites in the world. By 2040, about 95% of all purchases are expected to be made online[5].




**Graph 1.1: Effects of digitalisation on trade.** Source: Seizing opportunities for digital trade, OECD

The following advantages can be obtained through digital trade (Graph 1.1):

- because of lower trade costs, more traditional trade across all sectors (natural resources, agri-food, low-tech and high-tech manufacturing and services)
- more digitally ordered parcels crossing borders, making trade more accessible to micro, small, and medium-sized firms (MSMEs) and individuals, as well as repercussions for customs and other agencies dealing with the increased influx of parcels.

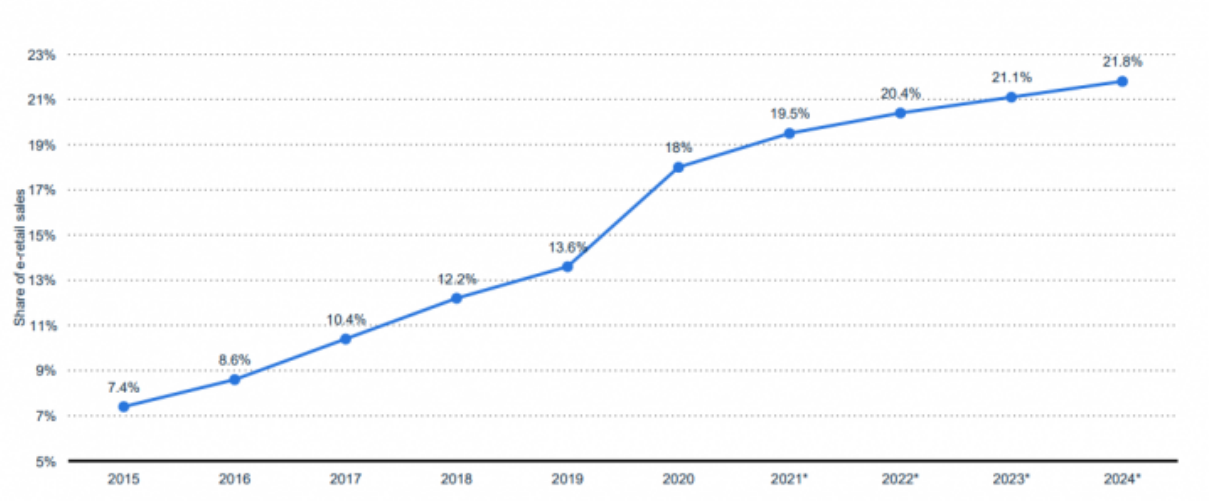
[5] Bugembe, M. (2022). Grow Or Die The New Reality of eCommerce. [online] Forbes. Available at: https://www.forbes.com/sites/mikebugembe/2022/05/06/grow-or-die-the-new-reality-of-ecommerce/.

- more digitally supplied trade, encompassing new services (for example, intermediation or cloud computing services) and lower-value services (apps) frequently delivered via new technology (platforms).
- more bundled or "smart" items (smart speakers, Internet of Things) that combine the features of commodities and services and are continually connected
- increasingly digitalized trade procedures, allowing for more efficient border crossing of commodities, as well as broader acceptance and/or recognition of e-signatures, e-contracts, e-communications, and e-transferrable records
- more cross-border data flows, which underpin all digital trade transactions and present new challenges (for example, privacy, national security, intellectual property protection, cybersecurity, and industrial policy).

Digital trade is important since it provides a variety of benefits. Countries with greater digital connectivity, such as increased Internet usage, benefit from more trade openness and sell more products to a wider range of markets. More digitization equals more trade. A 10% increase in digital connectivity between nations increases goods trade by almost 2% and services trade by more than 3% [3]. Importantly, these favourable benefits are shown across all industries (Figure 1). So, whether you're exporting carrots, cardigans, copper, home appliances, or laptops, digitalization has the potential to boost exports.

The coronavirus pandemic had a significant impact on ecommerce and online consumer behaviour around the world. As millions of people stayed home in early 2020 to prevent the wide spread of the virus, digital channels became the most popular alternative for temporarily closed stores and shopping. Alibaba, Amazon, ASOS, eBay, Flipkart, JD, PayPal, Yandex Market, Wildberries, Lamoda and others increased their sales volumes and received a significant increase in profits. The chart below shows a clear upward trend in total global retail sales from 2019 to 2020, providing a considerable boost to the forecasted 8% rise in retail ecommerce sales worldwide through 2024. This demonstrates an

increase in online retail sales as a result of the paradigm change brought about by COVID disruptions




**Graph 1.2: eCommerce Share of Total Global Retail Sales 2015-2024.** Source: International Trade Administration U.S. Department of Commerce

In 2023, the United States, was the world's largest e-commerce market. According to eMarketer, the US market reached $1.14 trillion in yearly sales, exceeding China's estimated $1.01 trillion. While China remains a major player, its e-commerce growth has slowed in recent years. The Asia-Pacific region holds 62.6% of the global e-commerce business due to China's overwhelming domination in this field. According to Statista research, in 2021, Uzbekistan's e-commerce generated $1.39 billion in revenue, accounting for 90.2% of total digital revenues. The remaining 9.8% was accounted for digital media, e-services, and e-health. Uzbekistan has a low level of digital expenditures, accounting for 3.91% of consumer spending in 2021, compared to an average of 7.34% in Asia. By 2025, e-commerce revenues are predicted to expand at an annual rate of 18.7% on average (Graph 1.2).

By the end of 2021, mobile commerce is predicted to account for 73% of all e-commerce purchases, emphasising the importance of mobile platforms in consumer behaviour. Smartphones and tablets provide convenience and accessibility, which contributes to the expansion of e-commerce. However, new difficulties have evolved, such as cyber threats and data privacy concerns, with

Cybersecurity Ventures forecasting that cybercrime will cost the globe $6 trillion per year by 2021.

Obviously, when discussing cross-border trade, it is impossible to avoid mentioning logistics, as digitalization is progressively affecting the processes of delivering finished goods to consumers. Transportation, warehousing, inventory, and order management are all transitioning to digital technologies. Digital logistics digitises traditional data collection, which is often manual and subject to human error or delay, in order to improve and expedite logistics processes, strategies, and systems. In other words, it automates sections of the logistics chain that are routine based. Digital logistics can have an impact on any aspect of a company's supply chain, including:

- Inventory management.
- Transportation management
- Warehouse management systems (WMS)
- Forecasting and analytics in the supply chain
- Notifications to customers and real-time shipment tracking.

The widespread substitution of electronic transport documents with paper ones is a prime illustration of how digital economy technologies are being used in logistics. 10% to 15% of transportation expenses are related to the creation of paper documents and delivery delays brought on by registration. These costs and delivery times can be lowered by 20-40% when digital logistics based on electronic document management are used, depending on the specific organisation.

Unmanned cargo drones are becoming a reality, removing the need for costly equipment support while also making them safer. Pipistrel, a Slovenian aircraft manufacturer, will launch two vertical take-off and landing aircraft in 2020. The application of the Internet of Things (IoT) in warehousing enables smart inventory, product monitoring, and drone delivery. Warehouse robotization is also gaining popularity, with Amazon deploying over 100,000 robotic systems

to automate storage, picking, and packaging. The market for ground unmanned vehicles is predicted to exceed $45 billion by 2025, with McKinsey Global Institute projecting that by 2025-2027, every third truck on European roadways will be driverless.

## 1.3. Theoretical approaches to determine the concept of digitalization and its development characteristics in international trade

A precise conceptual definition of digitalization is crucial because there are two closely related and frequently used meanings of the term interchangeably in a wide range of literary works. A search on Google Scholar results in roughly 571,000 hits for the term "digitization" and approximately 221,000 hits for "digitalization" The first definition describes digitization as the process of converting analogue data (e.g., photos, video, text) into digital format. Brennen and Kreiss describe digitization as the process of turning analogue streams of information to digital bits [6] . The second importance is associated with digitalization, which is defined as the adoption or increased usage of digital technology by organisations, industries, and governments[7].

It is widely acknowledged that the digital economy is the economy of the fourth industrial revolution. It is based on digital resources and closely relates to modern information and communication technologies' production, exchange, and consumption. Society is transitioning from a material-oriented economy to a highly developed digitalized economy under the conditions of digitalization. However, a single, comprehensive definition of the concept of the digital economy has yet to be developed, and it is defined variously in many scholarly publications [8] (Table 1.1). Since technology may improve the effectiveness,

[6] Brennen, J.S. and Kreiss, D. (2016). Digitalization. The International Encyclopedia of Communication Theory and Philosophy, 1(11), pp.1–11. doi:https://doi.org/10.1002/9781118766804.wbiect111.
[7] Gorenšek, T. and Kohont, A. (2019). Conceptualization of digitalization: opportunities and challenges for organizations in the euro-mediterranean area.
[8] Borzenko, O. and Hlazova, A. (2022) 'THEORETICAL APPROACHES TO RESEARCHING DIGITALIZATION PROCESSES IN THE GLOBAL ECONOMY,' Journal of European Economy, (Vol 21, No 3 (2022)), pp. 307–322. https://doi.org/10.35774/jee2022.03.307.

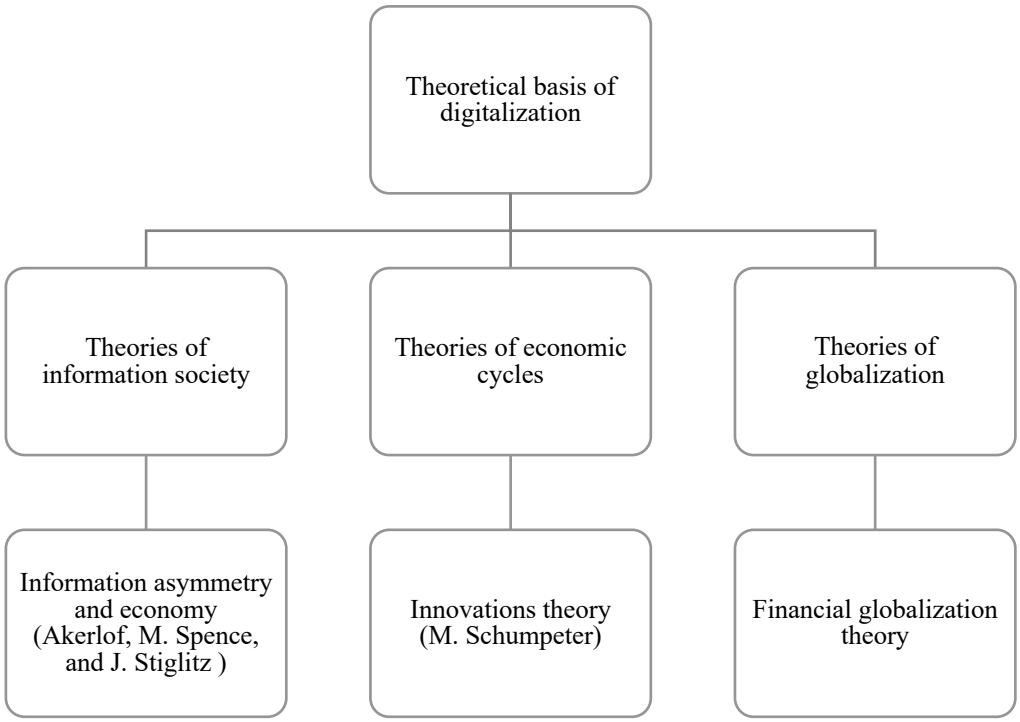
affordability, and standard of economic, social, and private activities, digitization is a significant driver of economic growth. The primary objective of digitalization is to create new and digitally transform current economic sectors, thereby changing the primary domains of human activity into more modern and efficient ones.

**Table 1.1 The concept of the digital economy.** Source: Borzenko and Hlazova, 2022

| № | Institution | Definition of digital economy |
|---|---|---|
| 1. | World Bank Group | a paradigm of accelerated economic development based on data exchange in real time |
| 2. | Organization for Economic Cooperation and Development | a set of transformational effects that were resulted because of new technologies action in the field of information and telecommunications. |
| 3. | European Parliament | a complex structural process consisting of numerous stages interconnected by an almost endless and constantly expanding number of nodes. Platforms are interconnected in the sense that they allow users to communicate directly through different channels, making it difficult to exclude specific participants, i.e. competitors. |

We must emphasize the primary theoretical foundations of the development of the digitalization process since it is a very complicated systemic phenomenon. These include theories of the information society, which explain the function and position of knowledge and information in the economy; theories of economic cycles, which depict the system's qualitative changes and dynamic development;

and theories of globalization, which explain the processes and mechanisms by which digitalization is spreading across the globe (Graph 1.3)




**Graph 1.3 theoretical foundations of the development of the digitalization process.** Source: Theoretical approaches to researching digitalization processes in the global economy[7]

Although these theories are not flawless in practice, they do identify the fundamental ideas behind the digitalization of world economy. Borzenko and Hlazova discuss the key theoretical basis of the process of digitalizing the economy in their work[9].

*Theories of information society*: The information economy solves information asymmetry. Nobel laureates J. Akerlof, M. Spence, and J. Stiglitz introduced and studied the idea of markets with asymmetric information [6]. According to them, information asymmetry is a scenario in which one participant in a transaction has more and better information than the other. This information gap can cause market inefficiencies and distortions, influencing the results of economic exchanges. In the presence of knowledge asymmetry, J. Stiglitz mathematically demonstrated the impossibility of reaching general market equilibrium. In such circumstances,

[9] Borzenko, O. and Hlazova, A. (2022) 'THEORETICAL APPROACHES TO RESEARCHING DIGITALIZATION PROCESSES IN THE GLOBAL ECONOMY,' Journal of European Economy, (Vol 21, No 3 (2022)), pp. 307–322. https://doi.org/10.35774/jee2022.03.307.

governmental involvement in specific industries helps to balance the functioning of the market economy. Equalization or removal of asymmetry is only achievable within the framework of developing the information economy and governmental regulation.

*Theories of economic cycles*: The theory of innovations was founded by J. Schumpeter, who also identified long-wave fluctuations as an expression of the economic dynamics that emerge from the development of innovations [7]. According to his findings, introducing innovations into the nation's economy creates a "whirlwind of creative destruction" that disturbs the equilibrium of the current economic system. It pushes it to leave outdated systems and dysfunctional organizational structures. As a result, new sectors and industries are created, which is precisely what propels the economy's expansion. Schumpeter believed that the generation of long waves depended on clusters of innovations (Schumpeter, 1939) [7].

*Theories of globalization*: Theoretically, digitization not only makes it possible to reduce or even completely eradicate the phenomenon of information asymmetry but may also be used as a tool to solve several other economic problems. Take the Mundell-Fleming model, for instance, which asserts that a financial system cannot support a free flow of capital, a stable exchange rate, and an independent monetary policy simultaneously. It was created in the early 1960s as a Keynesian extension of the LM-IS model for the case of an open economic system by American economists R. Mundell [8] and J. Fleming [9]. According to the theory's theoretical foundations, only two of the three conditions can be supported concurrently. It is called the "impossible trinity" problem. In the current circumstances of the digital ecosystem, this can be resolved practically. Digitization can assure the free flow of capital, while the government can support two pillars: independent monetary policy and a stable exchange rate. The digital economy became the foundation of the Fourth Industrial Revolution and the third wave of globalization.

In summary, the digital transformation of the world economy is a complex process based on the theories of the information society, economic cycles, and globalization. Despite their practical limitations, these theories provide information on the fundamental principles driving this transformation. Navigating the opportunities and difficulties posed by ongoing shifts in the digital economy requires an understanding of these theoretical foundations.

# CHAPTER II. ASSESSMENT AND DEVELOPMENT OF FOREIGN TRADE ACTIVITIES OF REGIONS IN THE CONDITIONS OF DIGITALIZATION

## 2.1. Methodological approaches to the assessment of the degree of digitalization of regions

There are many methods to assess the level of digitalization, but they are all based on creating a digitalization index that will be used as a benchmark to measure region's progress in integrating digital technologies in all sectors of the economy.

Several years ago, Tufts University's Fletcher School of Law and Diplomacy published Digital Planet: Readying for the Rise of the e-Consumer [10], based on a research study by the Fletcher School in collaboration with MasterCard. It explores the economic transformations taking place around the world as countries continue their evolution toward the 21st century digital age. In the report, the Digital Evolution Index is presented, which is designed to quantfy each advanced and developing country's unique digital journey, measures the pace at which their digital evolution is changing, and provides companies, investors and governments with information-based insights.

The index consists of four underlying factors:

- **Supply Conditions**: How advanced are digital and commercial infrastructures? Measures include accessible bandwidth, digital content, transaction security, consumer financial services, and road condition.
- **Demand Conditions**: Are customers eager and capable of transacting in the digital environment? Measurements include consumer income, consumption, demographics, broadband and mobile Internet use, social media use, and digital banking and payment services.

- **Institutional Environment**: Do government policies and laws promote the development of digital ecosystems? Indicators include political stability, rule of law, corruption, investment and trade laws, ease of doing business, and e-government services.
- **Innovation and Change**: What level of innovation is required to support a thriving digital economy? Investment in digital ecosystems, a focus on customer service, acceptance of new technologies, ease of starting a firm, and the availability of venture funding are all indicators.

The main disadvantage of this index is that it reflects the state of the country and is not applicable to regions. The Digital Evolution Index divides countries into 4 categories (Graph 2.1), such as Stand out, Stall out, Break out, Watch out.

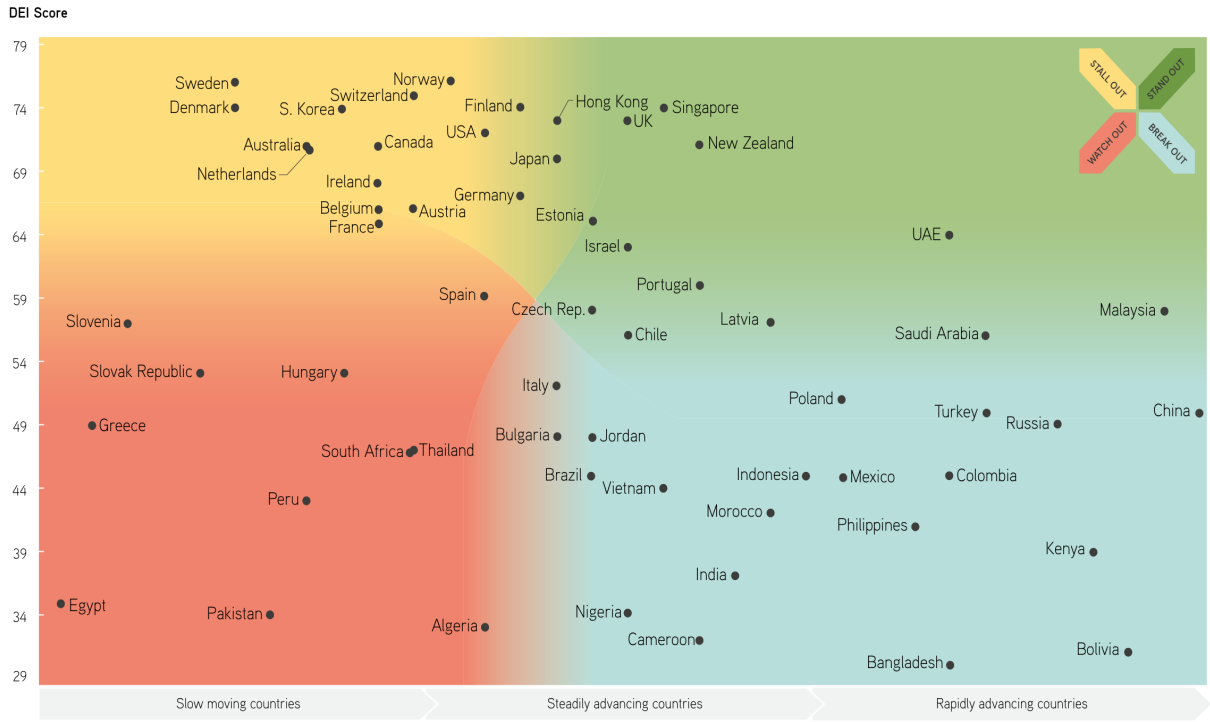
**"Stand Out"** countries use digital technologies extensively in their economy and society, thus establishing itself as an innovative leader in the field. These countries allocate a sufficiently large amount of funds to the development of technology and innovation so as not to lose their leadership positions. The top performing countries in the Stand Out zone are the US, Singapore, Hong Kong, South Korea, and Switzerland.

**"Stall Out"** countries also have a high level of implementation of digital technologies in the economy and society, but they are gradually losing their positions. In particular, in 2017 the leaders of this rating were Denmark, Finland, and Switzerland, but now they are in a state of stagnation. In order to overcome this obstacle, they need investment infusions of funds into the development of innovation and technology.

**"Break Out"** countries are those that currently score lower on digital development but are improving quickly and have the potential to become powerful digital economies. While they have the potential to become Stand Out nations in the future, they first need to get beyond a few significant obstacles, such as increased consumer demand, development-oriented government policies, and

infrastructure upgrades. Malaysia, China, Chile, and South Africa are among the leading candidates to advance to the next phase.

**"Watch Out"** countries such as Indonesia, Russia, Nigeria, Egypt, and Kenya have poor digital development scores and low rates of advancement. While there are potential for improvement, they confront considerable obstacles. Some of these countries are overcoming their limits through smart solutions, but others appear to be making little progress or falling farther behind.




**Graph 2.1 Digital Evolution Index 17.** Source: The Fletcher School at Tufts University in partnership with Mastercard.

Another "Digitalization Index" is composed in the study by Raul Katz, Pantelis Koutroumpis and Fernando Martin Callorda at Columbia University [11]. This index shows the digital progress of 184 Latin American countries between 2004 and 2011. The Index was created using six subindexes, which include ubiquity, affordability, reliability, speed, usability, and skill. There are 24 subindicators in each of these subindexes (Table 2.1). 184 counties were divided into four categories based on the index: constrained, emerging, transitional, and advanced. As a result, they found large differences between countries in the level of digitalization in the Latin American region.

**Table 2.1 Digitalization index components.** Source: Raul Katz, Pantelis Koutroumpis and Fernando Martin Callorda at Columbia University (2013)

| ***Indicators*** | ***Components*** | ***Sub-components*** |
|---|---|---|
| *Affordability* | Residential fixed line cost adjusted for GDP per capita | Residential fixed line tariff (three minute call to a fixed line at peak rate) adjusted for GDP per capita<br>Residential fixed line connection fee adjusted for GDP per capita |
| | Mobile cellular cost adjusted for GDP per capita | Mobile cellular prepaid tariff (one minute call off-net at peak rate) adjusted for GDP/capita<br>Mobile cellular prepaid one-time connection fee adjusted for GDP per capita |
| | Fixed broadband internet access cost adjusted for GDP per capita | Monthly residential price for a fixed broadband connection |
| *Infrastructure reliability* | Investment per telecom subscriber (mobile, broadband and fixed) | Mobile investment per telecom subscriber<br>Broadband investment per telecom subscriber<br>Fixed line investment per telecom subscriber |
| *Network access* | Network penetration | Fixed broadband penetration per household<br>Mobile phone penetration |
| | Other penetration metrics and coverage infrastructure | 3G/4G penetration<br>Mobile broadband penetration<br>PC population penetration<br>Mobile cellular network coverage |
| *Capacity* | International internet bandwidth<br>Broadband speed | International internet bandwidth (kbps/user)<br>Broadband speed (Peak Mbps, Average Mbps) |
| *Usage* | Internet retail<br>e-Government<br>Individuals using the internet<br>Non-voice services as percent of wireless ARPU | Internet retail as percent of total retail<br>UN web measure index<br>Percentage of individuals using the internet<br>Non-voice (data, message, VAS) spending as percentage of wireless ARPU |
| | Social network visitors | Dominant social network unique visitors per month per capita |
| | SMS usage | SMS usage per subscriber |
| *Human capital* | Engineers<br>Skilled labor | Engineers as a percentage of total population<br>Labor force with more than a secondary education as a percentage of the total labor force |

The disadvantage of this index is that it does not reflect the use of digital technologies in business, but shows only the parameters of ICT implementation in the country.

The Digital Economy and Society Index (DESI) includes many more factors and provides an overview of the state of digitization in EU countries. The European Commission publishes the DESI index each year to track member states' digital progress and it is measured based on 5 subindexes (Table 2.2). The DESI index is calculated using databases from Eurostat, ITU, and the UN. The key advantage of this indicator is that it's able to assess the economy's digital transformation by indicating the level of integration between business and government. This ranking is exclusively assessed for countries in the European Union. According to this index, Finland, Sweden, the Netherlands, Denmark, the United Kingdom, and Luxembourg are the most digitally advanced countries in the European Union. Bulgaria, Romania, Greece, Poland, and Italy are the countries that fall behind.

The UN Global E-Government Development Index analyses the use of ICT by citizens of the country in the area of public services. The country's rating is based on three criteria: "the degree of coverage and quality of Internet services, the level of development of ICT infrastructure, and human capital." According to this classification, Denmark, South Korea, Estonia, Finland, Austria, and Sweden have the most advanced e-government systems. Uzbekistan ranks only 69th in this list (2022). South Sudan, Eritrea, Somalia, the Central African Republic, Chad, and Niger are the countries following behind. The downside of this indicator is that it only evaluates the level of usage of government services.

Thus, there is a fairly large number of both international and domestic approaches that are aimed at assessing the level of digitalization, but most of these methods characterize certain areas of development of the digital society, or consider digitalization at the country level.

**Table 2.2 The Digital Economy and Society Index (DESI) structure.** Source: Digital Economy and Society Index (DESI) 2022, Methodological Note

| Dimension | Sub-dimension | Indicator |
|---|---|---|
| Human capital | Internet user skills | At least basic digital skills<br>Above basic digital skills<br>At least basic digital content creation skills |
| | Advanced skills and development | ICT specialists<br>Female ICT specialists<br>Enterprises providing ICT training<br>ICT graduates |
| Connectivity | Fixed broadband take-up | Overall fixed broadband take-up<br>At least 100 Mbps fixed broadband take-up<br>At least 1 Gbps take-up |
| | Fixed broadband coverage | Fast broadband (NGA) coverage<br>Fixed Very High Capacity Network (VHCN) coverage |
| | Mobile broadband | 5G spectrum<br>5G coverage<br>Mobile broadband take-up |
| | Broadband prices | Broadband price index |
| Integration of digital technology | Digital intensity | SMEs with at least a basic level of digital intensity |
| | Digital technologies for businesses | Electronic information sharing<br>Social media<br>Big data<br>Cloud<br>AI<br>ICT for environmental sustainability<br>e-Invoices |
| | e-Commerce | SMEs selling online<br>e-Commerce turnover<br>Selling online cross-border |
| Digital public services | e-Government | e-Government users<br>Pre-filled forms<br>Digital public services for citizens<br>Digital public services for businesses<br>Open data |

Using the ITU's ICT Development Index (IDI) methodology, which includes indicators for ICT access, use, and skills, experts from the Institute for Forecasting and Macroeconomic Research (IPMI) evaluated the state of ICT development throughout Uzbekistan's regions. The indicator, which was measured between 2015 and 2021, indicates that the national average increased overall, from 6.04 to 6.96. The regions with the highest IDI scores in 2021 were Bukhara (7.06), Navoi (7.41), and Tashkent (9.28). Over the time, Khorezm

(+1.20), Kashkadarya (+1.18), Namangan (+1.15), and the Republic of Karakalpakstan (+1.12) experienced the most growth[10].

This methodology can be considered as helpful for assessing the digitalization levels of different regions. Through the use of a unified metric, it allows for accurate monitoring and comparison of ICT advancements across Uzbekistan's regions.

## 2.2. Approaches to assessing the impact of digitalization of international trade on the development of foreign trade activities of regions

After examining different methodologies to determine a nation's level of digitization, the next step is to look into approaches to assessing the impact of digitization on economic strength, societal well-being, and effective governance.

A recent article by Igor Matyushenko [12] explores possibilities for the development of entrepreneurship in the EU and Ukraine under the conditions of digitalization. It employs a three-stage methodical approach that focuses on institutional, economic, and technological variables. In the first stage, the author suggests an analysis of the dynamics of changes in entrepreneurial activity indicators in the EU countries and Ukraine in the context of economic digitalization. The following indicators were chosen:

- Doing business index from the World Bank;
- The World Digital Competitiveness Index (WDCI) developed by the Swiss Business School;
- The E-Government Development Index (EGDI), which represents the state of e-government development in UN member states;
- The Global Innovation Index (GII) ranks world economies according to their innovation capabilities.

In the second stage, author uses correlation and regression analysis to construct equations influencing entrepreneurship levels and the level of digitalization and

[10] UzDaily (2022). Rating of ICT development by regions of Uzbekistan compiled. [online] UzDaily.uz. Available at: https://www.uzdaily.uz/en/post/75702

innovation in the economies. The correlations are based on the Doing Business and EDGI indices, WDCI (World Digital Competitiveness Index), and GII (Global Innovation Index) indices. The impact of each component is analyzed, and the EU countries and Ukraine are classified based on their overall influence on entrepreneurial activity in the context of economic digitalization. The study also determines the prospects for entrepreneurial activity development in the EU and Ukraine in the context of economic digitalization. The e-government development index was shown to have the biggest impact on the growth of entrepreneurial activity out of the three factors. The countries with the most direct correlation between the growth of digital competitiveness, the digital government development index, and entrepreneurial activity include Belgium, Croatia, Italy, Slovakia, Luxembourg, the Netherlands, and Hungary.

In 2012, The Global Information Technology Report assessed the material impact of digitization using three variables: growth in GDP per capita, job creation, and innovation. 150 countries were analyzed using an econometric model which is based on classical Cobb-Douglas production function:

$$Y = A_{(t)}K_1 + BL_1$$

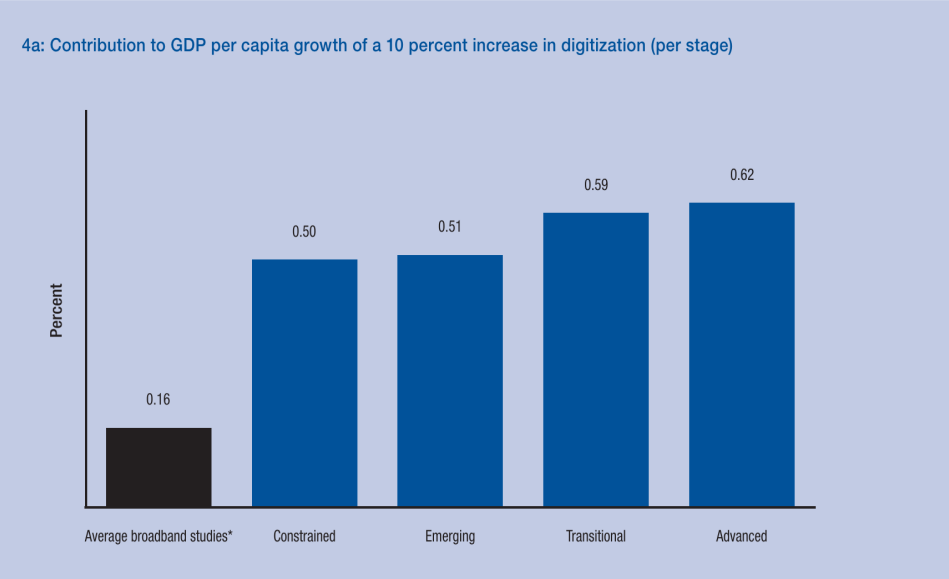
$$\log(GDP) = a_1 \log(K_{it}) + a_2 \log(L_{it}) + a_3 \log(D_i) + \varepsilon_{it}$$

Where:

- A(t) represents the level of technology progress (in this case the Digitization Index)
- K corresponds to the fixed capital formation
- L to the labor force
- i represents the country being analyzed and t represents time period or year

It was found that a 10 percent point rise in digitalization results in a 0.50 to 0.62 percent increase in per capita GDP. Previous studies, which focused only on broadband penetration, concluded that a 10-point increase in broadband penetration results in a 0.16 to 0.25 percent rise in per capita GDP. Therefore, the impact of digitalization on GDP is more than twice as great as the impact of broadband penetration (Graph 2.2). Additionally, as nations move into more

developed phases, the economic impact of digitalization increases. For every 10% rise in digitalization, constrained digital economies see a 0.5 percent gain in GDP per capita; advanced digital economies, on the other hand, get a 0.62 percent increase in GDP per capita.




**Graph 2.2 The Global Information Technology Report 2012.** Source: World Economic Forum

Digitalization has a major influence on job creation in the entire economy: a 10% rise in digitization lowers a country's unemployment rate by 0.84 percent. From 2009 to 2010, digitalization created an estimated 19 million employment in the global economy, up from 18 million in 2007 and 2008. This is an extremely important result for developing countries, which will need to produce hundreds of millions of jobs over the next decade to ensure that a growing number of young people can contribute to their respective economies.

Li, Zhang, and Zhuangzhuang Zhang [13] investigates the influence of the digital economy on inter-regional trade within China in their article1. The authors employ a panel data analysis of China's provinces from 2006 to 2017. Their key arguments are:

- The digital economy significantly bolsters inter-regional trade flows (both incoming and outgoing) and exhibits positive spatial spillover effects, meaning development in one region can influence neighboring regions.

- This positive effect is particularly pronounced in less developed and non-border regions, highlighting the potential for the digital economy to bridge regional divides.
- The digital economy primarily promotes inter-regional trade through two channels:
- Reduced trade costs: Digital technologies streamline logistics and financial processes, leading to lower transaction and transportation costs.
- Stimulated market demand: E-commerce platforms and digital marketing tools create new opportunities for businesses to reach customers across regions, fostering demand.

The study acknowledges that the digital economy's impact on resource allocation and technological innovation in promoting inter-regional trade requires further exploration. Although this article analyses the impact of digitalization on inter-regional trade, methodology and findings is similar to this case. At the practical application level, the digital economy is based on digital technology, and the use of information and communication technology, digital platforms, and blockchain technology may drastically lower trade costs. Some researchers have also investigated the possibility of the digital economy to improve bilateral trade and greatly increase domestic trade flows by developing a comprehensive digital economy index. Given the great degree of overlap between the Internet and digitalization, researchers have investigated the Internet's influence on domestic and international trade. Furthermore, several studies have discovered that the digital economy drives greater growth in local commerce than foreign trade, and the potential for improving inter-regional connection remains enormous.

Another study was conducted by Jun Wu and Tianyi Chen at the Shanghai University, which examines the dual circulation effect of the digital economy and the underlying process of effect. Using panel data from 30 Chinese provinces between 2011 and 2020, the impact of the digital economy on the degree of dual circulation sustainability was determined to be statistically significant and beneficial. According to the examination of the mechanism, growing

technological innovation capability can intensify the digital economy's influence on dual circulation. There is a geographical spillover effect to the digital economy's promotion impact. The digital economy plays a diverse role in promoting dual circulation, mostly affecting central and eastern China. This research uses following model to examine the effect mechanism:

$$CCD_{it} = a_0 + a_1 Dige_{it} + a_2 Z_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

In this equation,

- $C$CD$_{it}$ represents the degree of dual circulation development in area $i$ during time $t$.
- $Dige_{it}$ indicates the amount of digital economy growth in region $i$ during time $t$.
- Vector $Z_{it}$ is a set of control variables.
- The variables $\mu_i$ and $\delta_t$ represent fixed effects at the regional and temporal levels, respectively.
- $\varepsilon_{it}$ represents the random disturbance term. $\alpha_0$ represents the intercept term.

In this research, Digital economic development (Dige) indicator is assessed by Internet development and digital financial inclusion. According to Huang [14], this study uses data on four dimensions to assess Internet development: broadband penetration rate, Internet-related job status, Internet-related output, and smartphone penetration rate. The China Digital Inclusive Finance Index is also used to measure digital financial inclusion. Furthermore, the level of digital economic progress is calculated using principal component analysis on the standardised data.

It is clear that previous research is mostly focused on the influence of digitalization on interregional trade and the dual circulation effect within China. However, they are not directly relevant to analysing foreign trade activities in Uzbekistan; instead, it is necessary to develop a model that captures the distinctive dynamics of the country's economy and its relationship with digitalization.

Compared to statistical approaches using cross-sectional data, panel data analysis allows researchers to achieve a substantially better level of statistical

validity in data analysis and evaluation of models using more complex research designs. Panel data analysis has been utilized in many social science research papers and journal articles as a result of these benefits, and in recent years, academics have begun to employ it more and more.

At its core, panel data allows us to control for unobserved heterogeneity – persistent characteristics of individuals that aren't directly captured by the data but can influence the dependent variable. For example, in this case, regions have their own unique characterstics that have impact on foreign trade turnover, such as geographical location, culture. Panel data helps address this by including an individual fixed effect ($\alpha_i$) in the model. This effect captures all the time-invariant characteristics of individual 'i' that influence income.

As noted by Baltagi [15], one of the fixed effects model's main advantages is its capacity to account for bias resulting from missing variables. It is possible to effectively handle unobserved heterogeneity, which might potentially obscure the connection between variables in a simple regression.

The mathematical representation of the fixed effects model:

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it}$$

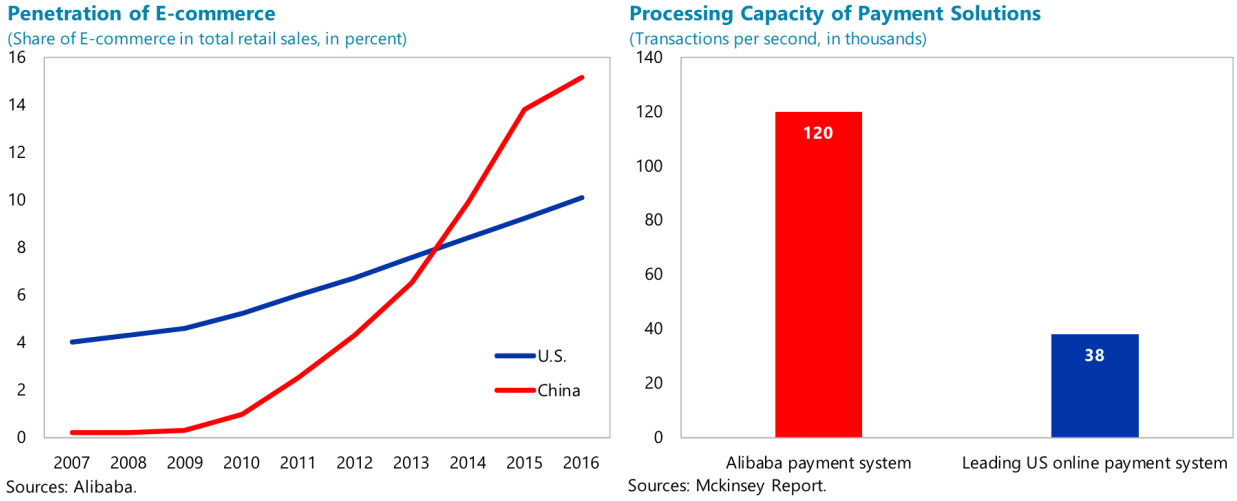
- $Y_{it}$: Dependent variable for individual 'i' at time 't'
- $\alpha_i$: Individual fixed effect for individual 'i'
- $\beta$: The effect of the independent variable on the dependent variable
- $X_{it}$: Independent variable for individual 'i' at time 't'
- $\varepsilon_{it}$: Error term

This model is appropriate to analyse states of the region since it allows for the distinction of specific factors while retaining the overall connection among the independent and dependent variables.

## 2.3 Foreign experience in the development of foreign trade activity of regions in the conditions of digitization

China's digital economy has grown quickly in recent years. Although the average level of digitalization in the economy is lower than in advanced nations,

specific regions and industries, such as e-commerce and fintech, as well as coastal regions, are already highly digitalized. China's digital economy accounts for 6% of GDP, but in South Korea and Japan, where the IT industry is more advanced and dominates the economy, it accounts for 8–10%. China is ranked 50th out of 131 nations in the World Bank's digital adoption index, 59th out of 139 in the World Economic Forum index, and 36th out of 62 in the Fletcher School digital evolution index. It is worth noting that these indices represent averages of the whole economy, which masks the variations across Chinese industries and areas—some of which are far more digitalized than others, such fintech and e-commerce, as well as coastal regions. China makes up more than 40% of all transactions worldwide, and the country now has a 15% e-commerce penetration rate (of total retail sales), compared to 10% in the United States (Graph 2.3).




**Graph 2.3 Penetration rate and Processing capacity of payment solutions.** Source: China's Digital Economy: Opportunities and Risks. IMF Working paper

Over 70% of all worldwide companies' valuations are held by Chinese corporations. In 2016, individual mobile payments associated with consumption in China amounted to US$790 billion, which is eleven times more than in the United States. One of the biggest mobile payment companies in China has processing capacity that is over three times quicker than that of its American competitors, which is related to the size of this growing industry. Global IT companies from China have been growing quickly in foreign markets. Notably, in the payment sector, Chinese visitors may use physical stores in 28 countries

and areas outside of China to use Alipay and WeChat Pay, the two widely used third-party payment applications in China.

China is also one of the world's top investors in digital technology. China's venture capital market has expanded quickly, with a growing emphasis on the digital industry. China's total venture capital has increased dramatically, with $38 billion spent overseas, from US$12 billion in 2011–2013 (6 percent of global total) to $77 billion in 2014–2016 (19 percent of global total), according to estimates provided by McKinsey. Fintech, AI, and big data are the three key industries that draw venture capital investment. China is now among the top three countries in the world for venture capital investments in critical digital technologies, such as automated driving, 3D printing, robotics, drones, and artificial intelligence.

The success of China's new digital industries has been attributed to a number of factors. Firstly, in the early days of digital growth, China's financial inclusion was still restricted when compared to sophisticated nations. In 2011, 64 percent of adults in China owned an account, compared to more than 90 percent in Japan, Korea, and Germany. Small and medium-sized businesses have limited access to loans through the conventional banking channel. This created a significant demand for services from non-bank financial service companies. Secondly, China has a massive base of 700 million internet users, including 282 million digital natives (internet users under the age of 25), who are ready to adopt new technologies. In comparison, internet users in India, a country with nearly the same population as China, were about 60% of China's size in 2016, whilst the United States, the current digital leader, had less than 300 million users, indicating a smaller population.

Government initiatives have supported the digital economy in a variety of ways. Investment in digital infrastructure has been especially crucial in accelerating the growth of digital industries. Reflecting ongoing government investment, digital infrastructure has developed dramatically in recent years, and is now generally comparable to leading nations. The government encourages

innovation by implementing mild restrictions throughout the early stages of development. These efforts accelerated the growth of new industries. China's quick progress in digitization has also been made possible by the public's comparatively low concerns about data privacy.

China might be considered a pioneer in developing the country's ICT industry. The state projects "Plan 863" and "Torch" were initiated in 1986 and 1998, respectively. The "State Medium- and Long-Term Plan for the Development of Science and Technology" planned for the period until 2020, was issued by the People's Republic of China's State Council in 2006. It identifies smart sensors, smart robotics, and augmented reality as key technologies.

Since the 2010s, China's approach has begun to shift towards the development of its own autonomous high-tech industry. In 2015, China adopted the idea of "Internet Plus", which encompasses five sectors of digital technology implementation: industry, public sector, agro-industrial complex, finance, and healthcare. Currently, the state's actions are focused on developing the necessary infrastructure for technological parks, special economic zones, and so on.

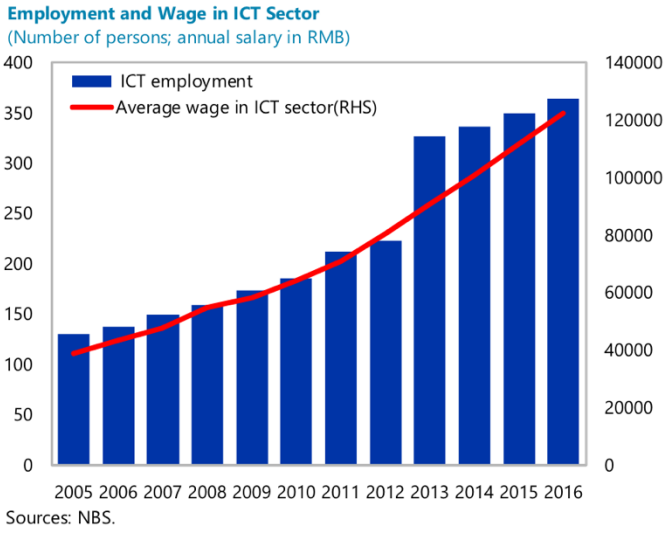
Furthermore, in 2017, the State Council of the People's Republic of China adopted the "National Plan for Stimulating Technological Developments in the Field of Artificial Intelligence", which outlines three strategic objectives. First, by 2020, China's AI sector should be on par with comparable industries in major developed nations, and AI technologies should serve as new engines of economic growth in China. The second goal is for China to become a leader in some fields of artificial intelligence by 2025. Finally, by 2030, China should be the world's leading centre of artificial intelligence innovation, with the basic sector worth $150 billion and allied industries worth $1.5 trillion.

There is a more specific document on the development of AI - the “Three-year Action Plan for Promoting the Development of New Generation Artificial Intelligence Industries”, released by the Ministry of Industry and Information Technology of the People's Republic of China in December 2017. It sets several

goals to stimulate development of “smart products” – cars connected to the Internet, smart robots and drones, facial and voice recognition systems.

The Chinese government encourages local companies to carry out mergers and acquisitions of foreign partners. A few years ago, Baidu opened a research and development center in Silicon Valley, and in 2017 the company opened a second center there for research and development of self-driving cars as part of its Apollo project. Soon the company's third laboratory opened in the USA - Business Intelligence Lab - for research and processing of Big Data. Another tech giant, Tencent, has opened an AI research center in Seattle.

Active government support in the field of AI has brought results. In 2019, Chinese companies and inventors around the world filed more than 110,000 patent applications related to AI technologies, making China the leader in AI patents, surpassing the United States for the first time. The most active uses of AI technologies in China are in the areas of video surveillance, financial sector, marketing and transport.




**Graph 2.4 Employment and Wage in ICT Sector.** Source: China’s Digital Economy: Opportunities and Risks. IMF Working paper

The sharing economy and the expanding e-commerce industry have emerged as China's new job-creation engines. With about 11 million SMEs using Alibaba's platform, the e-commerce industry has produced over 30 million employment in the last ten years. Thirteen million drivers use the Didi taxi platform, which is comparable to Uber in China. Although on a lesser scale, the

ICT industry has seen an increase in employment as well. In the last five years, 1.4 million high-skill jobs have been added, and since 2012, the average salary has doubled (Graph 2.4).

At the end of 2019, the COVID-19 pandemic suddenly broke out in China, which, paradoxically, stimulated the process of digital transformation of Chinese enterprises and especially the public service sector. China has sped up digital transformation in reaction to the economic effects of the pandemic. This has improved the nation's social and economic resilience and created an opportunity for long-term economic growth. More than 10 million corporate organisations have employed Alibaba's full suite of free home office support tools, which were offered to build a remote shared office model. Additionally, there are online office services available (such as instant messaging, video conferencing, employee training, smart staff, reporting logs, client and contract administration, and service information).

Billions of yuan have been invested in several high-tech businesses, like Graphite and Xiaoyu Yilian, to develop tools for the digital economy. During the pandemic, a lot of businesses started implementing work from home policies based on new products; real-time features like online attendance tracking, online hiring, and other working techniques have emerged. The epidemic has increased the rate of digital supply chain transformation. Chinese businesses are progressively integrating end-to-end visualisation and intelligent automation to improve equipment reaction time and efficiency while decreasing reliance on labour. According to Chinese researchers, after the epidemic, the digital transformation of enterprises and organizations will only accelerate. Due to the epidemic, the pace of adoption of cloud technologies and digital transformation of enterprises has increased. Digital technologies are restructuring organizations and processes, simplifying operations and making manufacturing business models more efficient. According to Chinese researchers, after the epidemic, the digital transformation of enterprises and organizations will only accelerate. Due to the epidemic, the pace of adoption of cloud technologies and digital transformation

of enterprises has increased. Digital technologies are restructuring organizations and processes, simplifying operations and making manufacturing business models more efficient. According to Bloomberg calculations based on IMF forecasts[11], China will be the driving force of global economic growth for at least the next five years. In 2021-2026 China will account for up to 20.4% of total global GDP growth, the USA will account for 14.8%, India – 8.4%, Japan – 3.5%.

[11] Zhang, L. and Chen, S. (2019). China's Digital Economy: Opportunities and Risks. [online] IMF. Available at: https://www.imf.org/en/Publications/WP/Issues/2019/01/17/Chinas-Digital-Economy-Opportunities-and-Risks-46459.

# CHAPTER III. DEVELOPMENT DIRECTIONS OF FOREIGN TRADE ACTIVITIES OF THE REGIONS IN UZBEKISTAN IN THE CONDITIONS OF DIGITALIZATION OF INTERNATIONAL TRADE

## 3.1. The policy of Uzbekistan's integration into the global economy in the context of digitalization

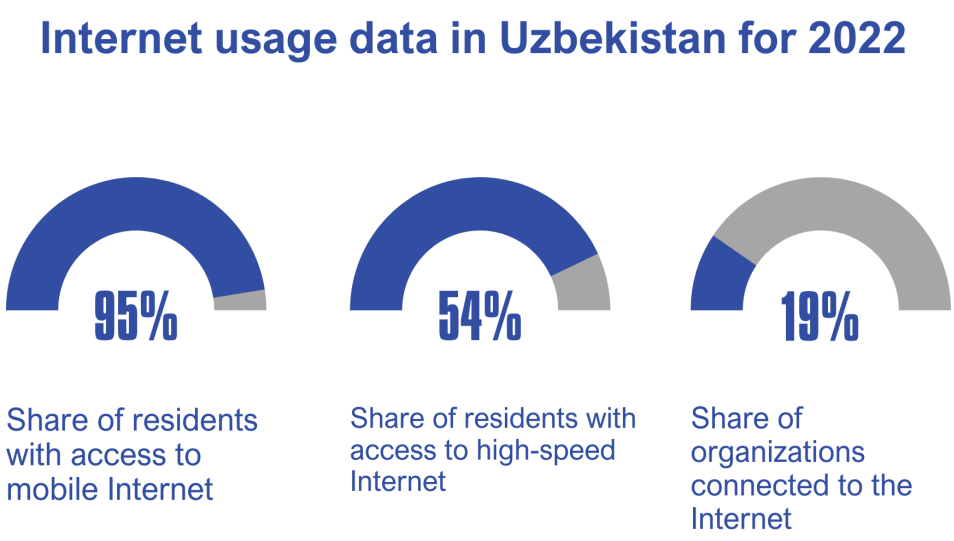
Uzbekistan's digitalization began around ten years ago. In 2012, the government of the Republic adopted the "Comprehensive Programm for the Development of the National Information and Communication System". The document's implementation was planned for the years 2013 to 2020. The nation's Unified Portal for Interactive Public Services was established in July 2013. Uzbek people could use a unified OneID system on the my.gov.uz webpage in 2016. It makes it possible to identify users, granting access to a variety of services provided by governmental organisations and private businesses. The Uzbek government established a strategy in 2017 that focuses on five key areas for the nation's growth between 2017 and 2021. The "Digital Uzbekistan - 2030" strategy was adopted in 2020. It includes over 220 priority projects that aim to improve the e-government system, expand the domestic software and information technology market, establish IT-parks throughout the nation, and supply qualified workers for these sectors[12].

The Republic of Uzbekistan's President, Sh. Mirziyoyev, announced a decree on "measures for the widespread introduction of the digital economy and e-government" in 2022. It states that by 2023, Uzbekistan's GDP share of the digital economy will have doubled, and by 2022, the share of electronic public services should reach 60%. All around Uzbekistan, digital knowledge training centres will open. According to the study, the digital economy will develop more quickly and account for twice as much of the national GDP by 2023.

[12] Global CIO. (2023d). Digital transformation of Uzbekistan. [online] Available at: https://globalcio.com/articles/main/digital-transformation-of-uzbekistan/.

By 2020–2021, every healthcare facility, school, kindergarten, village, and mahalla should have access to high-speed Internet. By 2022, the percentage of electronic public services is expected to reach 60%. As part of the resolution, "digital entrepreneurship" is to be developed, with a three-fold increase in service volume and $100 million in export revenue by 2023.

In Uzbekistan, the accessibility of internet services varies among residents and organizations. While an overwhelming majority of residents, constituting 95%, have access to mobile internet, the availability of high-speed internet is comparatively lower, with only 54% of residents enjoying such access. Moreover, internet connectivity among organizations in the country remains relatively limited, with just 19% of them being connected to the internet (Graph 3.1). This divergence underscores the disparities in internet infrastructure and usage within Uzbekistan.




**Graph 3.1 Internet usage data in Uzbekistan for 2022.** Source: Global CIO. Digital transformation of Uzbekistan

Digital technology will be widely incorporated into the educational system at every level. As part of the Five Initiatives project, digital knowledge training centres will open nationwide until 2022. In terms of developing the digital economy and e-government, the Ministry for the Development of Information Technologies and Communications is recognised as the authorised organisation.

The President's National Agency for Project Management is still in charge of introducing blockchain technology and cryptocurrency assets. Two new organisations will be formed under the Ministry of Development of Information Technologies and Communications: the "Electronic Government Project Management Centre" and the Centre for Digital Economy Research. Both the management of the growth of geoinformation technologies and digital technologies in the agriculture sector have been created.

By registering websites in the national part of the Internet under the "UZ" domain, work was begun to provide useful services to customers, educate young people online, and give services to the population via electronic means. Additionally, significant progress was made in the area of online payments; in 2019, for instance, 299.3 million transactions totaling 6.5 trillion soums were made via online payment platforms.

The dynamics of worldwide digitalization rankings demonstrate the effectiveness of Uzbekistan's recent digital reforms:

- Based on the GovTech Quality Index, Uzbekistan has advanced 37 spots in the public services sector since 2020 and is now a member of Group "a" of 198 top digitally transformed nations.
- Uzbekistan moved up to the "high/very high level of development" category of nations in the 2022 UN e-government study (e-government survey), an annual rating released by the UN.
- Over the last four years, Uzbekistan has moved from 158th to 79th rank in the "Government Artificial Intelligence Readines Index" assessment created by the British organisation Oxford Insights.
- Uzbekistan is listed as a nation with a high level on the Telecommunications Infrastructure Index (TII). In terms of the cost of broadband internet, Uzbekistan is ranked 19th out of 220 nations.

The government encourages the expansion of IT businesses by removing customs tariffs on hardware, software, and other supplies used by ICT enterprises. Additionally, beginning last year, the excise tax on mobile communication

services for operators has been lowered to 10%. Residents of IT Park Uzbekistan are entitled to a wide range of advantages and favours. Operators and suppliers that build infrastructure for budgeting organisations in rural regions, as well as for recreation zones, tourism destinations, and transportation routes, are now eligible for tax incentives.

In 2019, an IT park was established in Uzbekistan. Its primary responsibilities include educating the public, assisting and promoting company growth, contributing to the formulation of specific laws, and building its own infrastructure. A number of the nation's cities now have educational facilities, and an IT town complete with corporate hubs, offices, and residential buildings is being built. By the end of March 2023, there were 1,262 residents working at IT Park, which is more than twice as many as there were the previous years.

There are 382 local IT businesses operating for export, with 172 of them involved in BPO. The United States accounts for 48 percent of digital exports, followed by the United Kingdom (15%), Singapore (10%), and the CIS nations (15%). Furthermore, 256 businesses provide IT instruction. The current IT Park educational offerings include of both paid and free courses.

In November 2019, the “One Million Uzbek Coders” initiative was introduced in Uzbekistan. This is similar to the One Million Arab Coders program, which has been working in the UAE since 2017. The Dubai Future Foundation collaborates with the Uzbek Ministry of IT Development and Communications to facilitate the program's implementation. Data analysis, Android programming, full-stack development, and front-end development are among the skills taught to its participants. Over 2.5 million customers have signed up for the program as of 2023. Over one million seven hundred thousand youth have been awarded certificates of accomplishment.

President Shavkat Merziyoyev of Uzbekistan has set the objective of fully digitising all operations in the oil and gas, chemical, and metallurgical industries by 2020. To promote digital transformation, Uzbekistan has built 19 free economic zones and more than 400 minor industrial zones, with 10 trillion soums

funded for their infrastructure. More than 600 new fields have been found through geological investigation, which has tripled in order to supply raw materials to the industry.

The UzAutoSanoat holding unites the vehicle manufacturing companies of Uzbekistan: GM Uzbekistan, Samarkand vehicle Plant, MAN Auto-Uzbekistan, and GM powertrain Uzbekistan. The holding has been working on a significant initiative to gradually switch to the SAP ERP/CRM system from 2019. The initial step was integrating SAP into UzAuto Motors' sales system, which will increase transparency and remove the human factor from the process. A comprehensive training program for university instructors and students was jointly introduced in 2019 by the SAP University Alliance and Turin Polytechnic University in Tashkent (TTPU). The initiative's goal is to provide skilled workers with the training they need to take part in UzAutoSanoat's digitalization programs.

The Republic of Uzbekistan's 2020–2025 Strategy for Reforming the Banking System intends to automate business procedures, provide remote banking services, and incorporate modern information and communication technology. The strategy calls for extending contactless payments, implementing scoring and credit conveyor systems, improving information security, and introducing new ideas such as fintech and digital banking. The country's payment system infrastructure has expanded dramatically, with 28 payment organisations established and 22 million individuals using remote banking services. The number of online payments will rise sharply in 2022.

The key trend seen in Uzbekistan nowadays is the shift from marketplaces to retail chains. The country's grocery business is already attracting interest from foreign competitors and investors. Major companies have already joined the market, such as the Russian brands Fix Price, Magnit, Svetofor, and Kazakh store Magnum Cash & Carry, as well as the French retailers Carrefour and SCHIEVER. Local firms growing quickly include Makro, Korzinka, Havas, Asia, and Baraka Market. The fast rise of retail chains creates a demand for advanced IT solutions, ERP systems, and new loyalty programs.

In Uzbekistan, the e-commerce industry is actively expanding and developing. The statistics office reports that Uzbekistan's e-commerce market nearly quadrupled in size in 2022 and is still expanding rapidly. The e-commerce market in Uzbekistan is predicted to expand within a range of 41.4% to 47.4% in the period 2023-2027[13], which is three times faster than the average growth rate for the world. The most well-liked categories in the biggest e-commerce market in Uzbekistan are B2C, including books, home and electrical items, apparel and footwear, cosmetics and health, food and necessities, and beauty and health. The next trend that Uzbekistan is probably going to witness is a movement in sales from offline to online[14].

Uzbekistan's economy has changed and become more digitally connected since the country began implementing extensive changes in 2017, which has sped up economic growth. A combination of policies has been implemented that have lowered obstacles to international investment, promoted economic transparency, and made the country's economy more competitive. With the help of the Internet and information and communication technologies (ICTs), society and economic institutions have undergone significant change, leading to higher levels of efficiency and production. ICT-generated innovations have the ability to significantly enhance society and open up new development areas for the nation.

### 3.2. Analysis of the state of foreign trade activity of the regions of Uzbekistan in the conditions of digitalization

To analyze current state of digitalization across Uzbekistan's regions, panel dataset is constructed by the author based on the statistical data from Stat.uz (Statistics Agency Under the President of the Republic of Uzbekistan) (See Appendix 3). The dataset consists of cross-sectional data, including economic data of Uzbekistan's regions from 2015 to 2022. There are 112 observations of 14 regions and 12 variables.

[13] KPMG (2023). Overview of e-commerce market in Uzbekistan - KPMG Uzbekistan. [online] KPMG. Available at: https://kpmg.com/uz/en/home/insights/2023/08/e-commerce-market.html.
[14] Global CIO. (2023c). Digital transformation of Uzbekistan. [online] Available at: https://globalcio.com/articles/main/digital-transformation-of-uzbekistan/.

**Table 3.1 Variables and their definition.** Source: Collected by author from Stat.uz

| Variable | Definition | Measure |
|---|---|---|
| GCI | Growth rates of the volume of communication and information services by region | percentage |
| IS | Number of subscribers with Internet access | thousand |
| APC | Information about the availability of personal computers (excluding servers) in enterprises and organizations | units |
| NCI | Number of computers connected to the Internet at enterprises and organizations | units |
| IA | The share of enterprises and organizations with access to the Internet | percentage |
| AW | Average monthly nominal wages of employees of legal entities whose main economic activity is "Information and Communication" | thousand soums |
| TNRS | Number of subscriber radio stations connected to the mobile communication system (total) | thousand |
| NRS | The number of subscriber radio stations connected to the mobile communication system in the region | per 100 people |
| NRSI | The number of subscriber (individuals) radio stations connected to the mobile communication system (by region) | per 100 people |
| SHPC | Share of enterprises and organizations with personal computers | percentage |
| SHLN | The share of enterprises and organizations with a local network | percentage |
| NCLN | The number of computers connected to a local network in enterprises and organizations | units |
| TT | Total foreign trade turnover | million US dollars |

**Table 3.2 Main descriptive statistics.** Source: Constructed by author

| Region | Year | Export | Import | GCI | IS |
|---|---|---|---|---|---|
| Length:112 | Min. :2015 | Min. : 76.2 | Min. : 50.9 | Min. :104.3 | Min. : 212.4 |
| Class :character | 1st Qu.:2017 | 1st Qu.: 198.9 | 1st Qu.: 285.6 | 1st Qu.:109.9 | 1st Qu.: 542.1 |
| Mode :character | Median :2018 | Median : 313.9 | Median : 532.7 | Median :114.2 | Median : 874.2 |
| | Mean :2018 | Mean : 617.8 | Mean : 1350.7 | Mean :116.1 | Mean :1147.6 |
| | 3rd Qu.:2020 | 3rd Qu.: 509.9 | 3rd Qu.: 1247.5 | 3rd Qu.:121.1 | 3rd Qu.:1380.4 |
| | Max. :2022 | Max. :4669.3 | Max. :14939.7 | Max. :143.1 | Max. :5385.0 |

| IA | AW | TT | TB | TNRS | NRS |
|---|---|---|---|---|---|
| Min. : 7.60 | Min. : 943 | Min. : 158.3 | Min. :-10270.40 | Min. : 523.6 | Min. : 20.20 |
| 1st Qu.:17.20 | 1st Qu.:1341 | 1st Qu.: 554.6 | 1st Qu.: -743.48 | 1st Qu.:1055.3 | 1st Qu.: 59.15 |
| Median :20.05 | Median :2107 | Median : 852.2 | Median : -243.15 | Median :1470.8 | Median : 66.05 |
| Mean :21.41 | Mean :2370 | Mean : 1968.5 | Mean : -732.95 | Mean :1760.8 | Mean : 74.68 |
| 3rd Qu.:24.93 | 3rd Qu.:2942 | 3rd Qu.: 1624.4 | 3rd Qu.: -52.15 | 3rd Qu.:2075.1 | 3rd Qu.: 74.15 |
| Max. :44.50 | Max. :9149 | Max. :19609.0 | Max. : 283.70 | Max. :7691.9 | Max. :264.40 |

| SHLN | NCLN | APC | NCI | NRSI | SHPC |
|---|---|---|---|---|---|
| Min. : 1.300 | Min. : 577 | Min. : 17331 | Min. : 3961 | Min. : 19.10 | Min. :15.00 |
| 1st Qu.: 3.175 | 1st Qu.: 1331 | 1st Qu.: 36562 | 1st Qu.: 10798 | 1st Qu.: 57.60 | 1st Qu.:38.02 |
| Median : 4.500 | Median : 1741 | Median : 50846 | Median : 16408 | Median : 64.45 | Median :47.15 |
| Mean : 4.507 | Mean : 2823 | Mean : 68217 | Mean : 28802 | Mean : 70.12 | Mean :47.73 |
| 3rd Qu.: 5.525 | 3rd Qu.: 2202 | 3rd Qu.: 62679 | 3rd Qu.: 26039 | 3rd Qu.: 70.12 | 3rd Qu.:57.40 |
| Max. :11.300 | Max. :23300 | Max. :381051 | Max. :236242 | Max. :197.20 | Max. :79.70 |

Based on the Table 3.2, it can be summarized that dataset provides information from 2015 to 2022. The analysis of various economic indicators provides a comprehensive picture of the digitalization and trade landscape across regions. In terms of exports, the data reveals a disparity where the minimum export value in some regions is 75.2 million US dollars, while on average, regions export products worth 617.8 million US dollars. However, more than 50% of regions report exports around 313.9 million US dollars, so there are potential outliers in the dataset that could skew the overall export figures. On the import side, regions appear to import more products than they export, with a mean import value of 1350.7 million US dollars. This is a trade deficit scenario where imports exceed exports on average, highlighting the dependency on foreign goods and services in these regions.

In terms of communication and information services, the growth rates (GCI) range from 104.3% to 143.1%, with an average growth rate of 116.1%, which indicates a significant upward trend in the adoption and utilization of digital communication technologies and services across the regions. The number of internet subscribers (IS) exhibits substantial variation, from a minimum of 212.4 thousand to a maximum of 5385.0 thousand, with a mean of 1147.6 thousand subscribers.

Furthermore, the share of enterprises and organizations with personal computers (SHPC) ranges from 15.00% to 79.70%, while the share with a local network (SHLN) ranges from 1.30% to 11.30%. These metrics show the different degrees of digital readiness and technology integration among businesses and organizations, which are crucial factors in assessing their competitiveness and efficiency in conditions of digitalization.

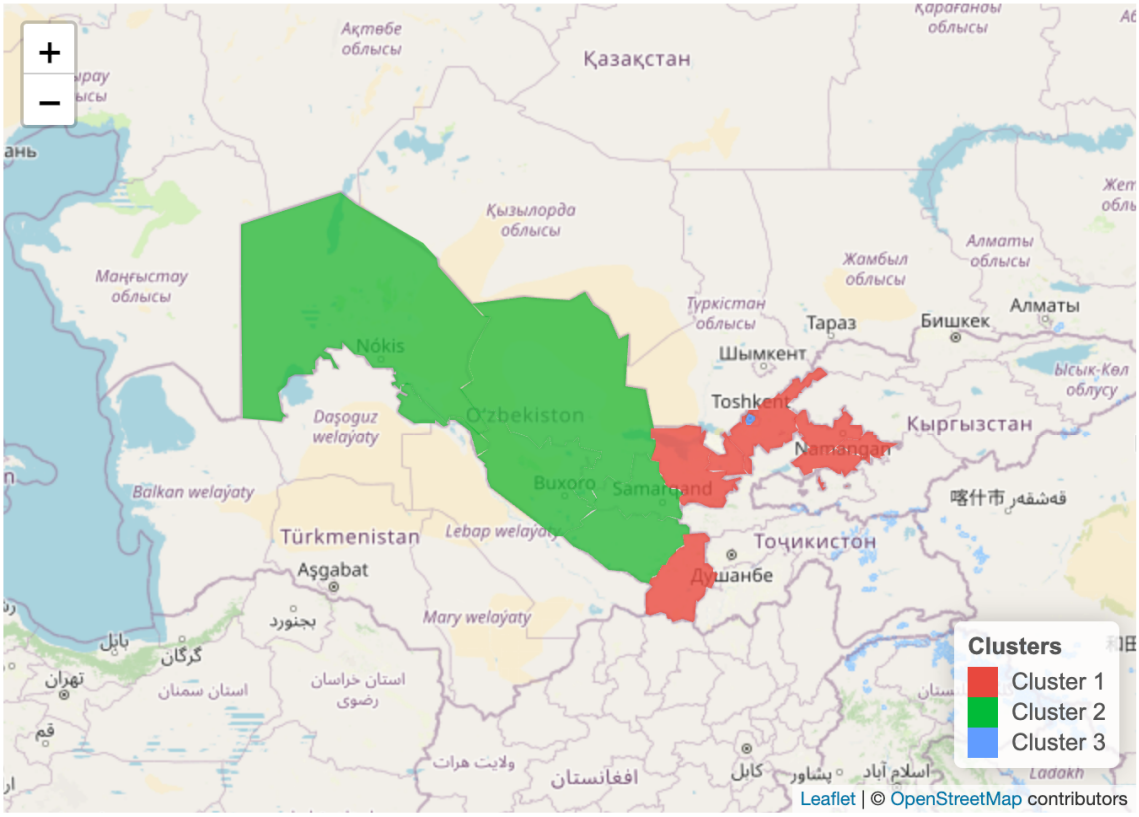
*Cluster analysis*

The summary of variables above explains general tendency among regions. And cluster analysis allows for a more comprehensive study based on the broad trends seen across different locations. By grouping the regions according to their commonalities, we may get better insights and uncover specific patterns within each cluster.


**Graph 3.2 Cluster Analysis based on k means and Cluster Analysis Result for 2022.** Source: Constructed by author

**Cluster 1** includes regions such as Namangan, Jizzakh, Tashkent, Andijan, Surkhandarya, Syrdarya and Fergana region. This cluster shows a low level of digitalization, especially in the field of information and communication services. With an average growth rate of 127.80% for communication and information services (GCI), the industry is expanding steadily. The remarkably small number of internet access in these regions indicates a limited adoption of Internet services by citizens (Graph 3.2). This may be the caused by a number of issues, such as poor digital literacy, inadequate infrastructure, or financial limitations that restrict

more access to Internet services. Furthermore, the availability of personal computers (SHPC) in businesses and organisations is relatively low, which possibly affects productivity and digital engagement inside organisations. A similar pattern of low connectivity is seen in the number of computers connected to the internet (NCI), which stands at average 29377.5 units. As only 13.46% of businesses and organisations have internet connection, it is clear that online connectivity should be improved. As a result, employment in the information and communication sector may not be as financially appealing in these regions, as the sector's average monthly nominal pay (4121.696 thousand soums) is relatively low compared to other regions.




**Graph 3.3 Uzbekistan's map of different clusters.** Source: Constructed by author

**Cluster 2** consists of 6 regions: Navoi, Bukhara, Samarkand, Khorezm, Kashkadarya and The Republic of Karakalpakstan, which have higher levels of digitalization than regions in Cluster 1. These regions, with an average GCI of 125.12%, are growing steadily, but lagging behind Cluster 1 (Graph 3.2). The Internet penetration is similar to Cluster 1 which has low number of Internet subscribers (IS). This indicates that further efforts to improve connection are

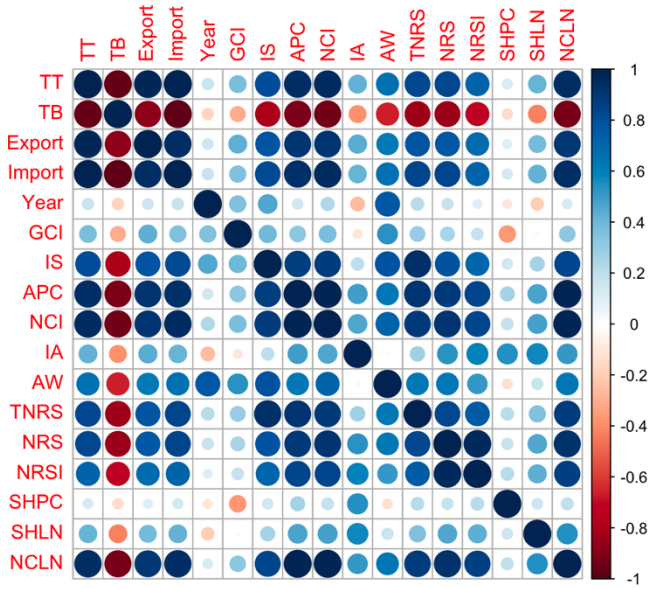
crucial. However, there is a strong demand for governmental interventions to speed up digital integration in business processes, since just 21.36% of firms and organisations have internet access (IA). Economic strategies are necessary to increase salaries and draw talented professionals to the information and communication sector, as evidenced by the sector's average nominal monthly pay (AW) is relatively low. Mobile connectivity, as assessed by the number of subscriber radio stations linked to the mobile communication system (TNRS) is spread substantially, with 74.39 stations per 100 persons (NRS) and 68.21 stations per 100 individuals (NRSI) (Appendix 2). Even though mobile connectivity is widely available, these numbers indicate that there is still more space for development. On average, only 40.9% companies have personal computers and 5.73% have local network, which means digital infrastructure within organizations has not completely developed yet.

Regions with the highest degrees of digitalization and advancement in communication and information services are represented by **Cluster 3**. However, there is only one region included in this cluster, which is Tashkent city. In this cluster, availability of personal computers in enterprises and organizations is exceptionally high, with average 381 051 units (Appendix 2). This cluster has the highest NCI (the number of computers connected to the Internet) among all clusters and it shows comprehensive connectivity and integration of digital resources. The share of enterprises and organizations with internet access (IA) is also the highest at 28.60%, which means adoption of online tools and platforms is widespread. The average monthly nominal wages in the information and communication sector (AW) are significantly higher at 9148.741 thousand soums, as a result this helps to attract top talent and more investment. Mobile connectivity metrics are also exceptionally high compared to other clusters, with 7691.900 thousand subscriber radio stations (TNRS), 264.4 stations per 100 people (NRS), and 157.6 stations per 100 individuals (NRSI). The digital infrastructure within organizations is also well-developed, with 43.00% having personal computers (SHPC) and 11.30% having a local network (SHLN).

*Correlation analysis*

After reviewing the present situation of each region, we may do a correlation analysis to better understand the relationships between the variables. This will help us identify how these factors are related and impact each other. Correlation between two variables reveals if they are significantly correlated and provides information about the strength and direction of the linear relationship between them. The correlation coefficient (r) can range from -1 to 1.

If r = 1, it means there is a complete positive correlation between variables. If r equals 0, there is no linear connection between the two variables. If r = -1, then there is a complete negative correlation between the variables.



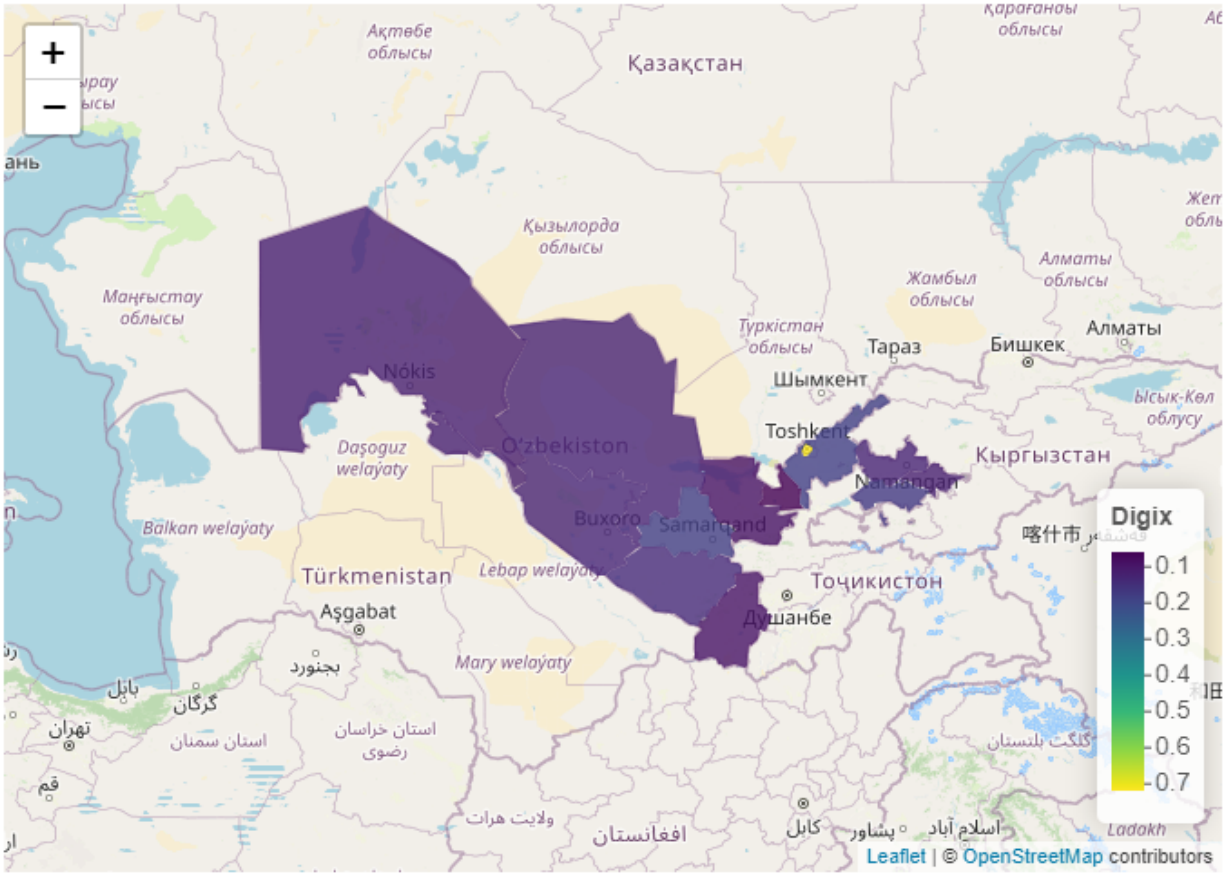

**Graph 3.4 Correlation matrix.** Source: Constructed by author

Apart from GCI, all variables significantly correlated with TT, but there is multicollinearity problem with these variables. To fix it is necessary to create single Digitalization index which can explain the dataset based on the methodologies provided in second chapter.

*Principal component analysis*

**Principal component analysis**, or PCA, is a dimensionality reduction method that is often used to reduce the dimensionality of large data sets, by transforming a large set of variables into a smaller one that still contains most of the information in the large set. In this study, we use principal component analysis (PCA) methodology to create a comprehensive digitalization index. This method

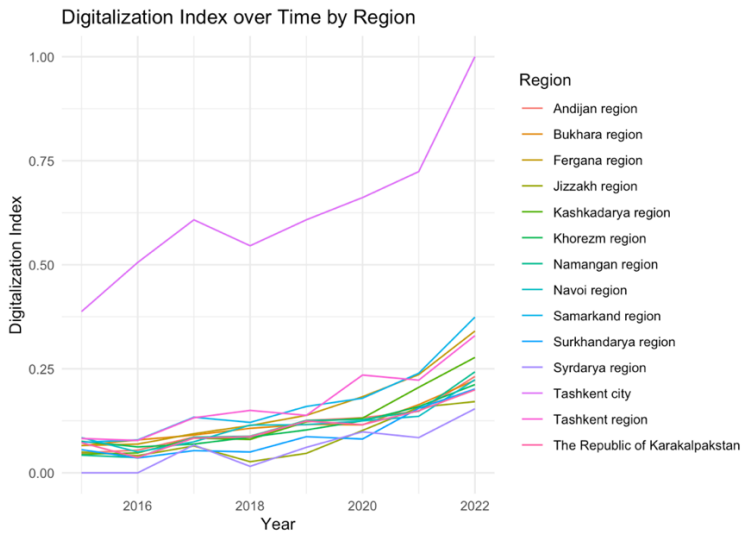
is similar to that implemented by Cámara and Tuesta in their working paper[15], "DiGiX: The Digitization Index". Using PCA, we may combine different digitization indicators into a single, coherent index, which provides a reliable measure of digitalization. The Scree plot indicate that PC1 can explain 63% of the dataset so this component is can be used as Digitalization index (Appendix 1)




**Graph 3.5 Uzbekistan map by DIGIX.** Source: Constructed by author

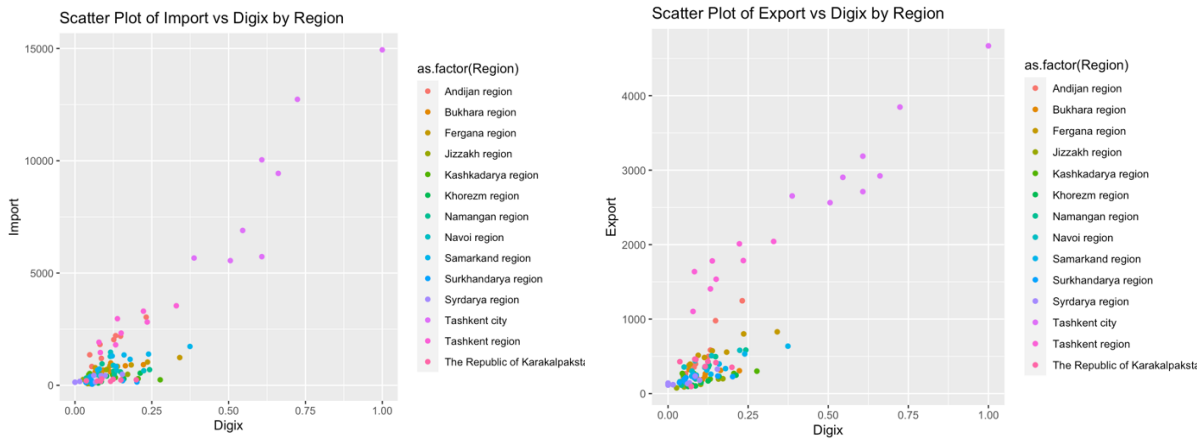
Based on the constructed index, this graph (Graph 3.5) illustrates the degree of digitalization across different regions. Tashkent city emerges as the frontrunner, which demonstrates the highest score. Following closely behind are Tashkent region, Fergana, and Samarkand, though other regions still exhibit incomplete digitalization level.

[15] Cámara, N. and Tuesta, D. (2017). DiGiX: The Digitization Index. [online] Available at: https://www.bbvaresearch.com/wp-content/uploads/2017/02/WP_17-03_DiGiX_methodology.pdf.




**Graph 3.6 Digitalization Index over Time by Region.** Source: Constructed by author

However, Graph 3.6 illustrates that the overall trend of digitalization is positive across all regions. This indicates that the government initiatives launched in 2016 have effectively yielded substantial benefits.

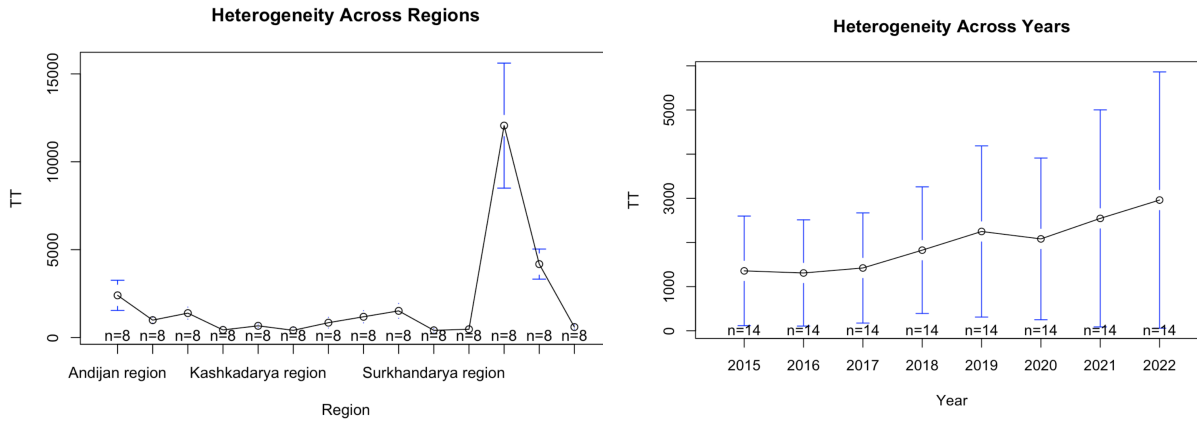



**Graph 3.7 Correlation matrix between Digix and Export, Import.** Source: Constructed by author

Clearly, there is a positive correlation between digitalization index and import in the first graph (Graph 3.7). Regions such as Tashkent city and Tashkent region exhibit high import values as their digitalization index increases. This pattern suggests that locations with greater levels of digitalization also tend to have higher import values, which means a considerable increase in import activity due to digitalization. Similarly, the second graph shows a strong positive correlation between export values and digitalization index, as Digix value increases, export values also rise.

*Panel data analysis*

Next, we will conduct a panel data analysis to investigate the influence of digitalization on international trade activities. This approach will allow us to investigate the dynamics across time and across geographies. We will try to construct several regression models to identify the best model.




**Graph 3.8 Heterogeneity graphs.** Source: Constructed by author

These graphs suggest that heterogeneity differs between distinct units, which means regions possess unique characteristics. This indicates that panel data analysis is the appropriate approach to conduct.

*Pooled Model*

We first estimated a pooled model to understand the relationship between total trade turnover (TT) and the digitalization index (Digix)

```
pooledOls <- plm(TT ~ Digix, data = pdata , model = "pooling")
summary(pooledOls)
```

```
## Pooling Model
##
## Call:
## plm(formula = TT ~ Digix, data = pdata, model = "pooling")
##
## Balanced Panel: n = 14, T = 8, N = 112
##
## Residuals:
##      Min.   1st Qu.    Median   3rd Qu.      Max.
## -3712.148  -559.065    68.143   721.669  3995.789
##
## Coefficients:
##             Estimate Std. Error t-value  Pr(>|t|)
## (Intercept)  -914.80     177.35 -5.1581 1.113e-06 ***
## Digix       18653.68     809.50 23.0434 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    1134100000
## Residual Sum of Squares: 194620000
## R-Squared:      0.82839
## Adj. R-Squared: 0.82683
## F-statistic: 530.998 on 1 and 110 DF, p-value: < 2.22e-16
```

**Graph 3.9 Pooled OLS Summary.** Source: Constructed by author

The estimated equation is:

$$TT_i = \beta_0 + \beta_1 \cdot Digix_{it} + u_{it}$$

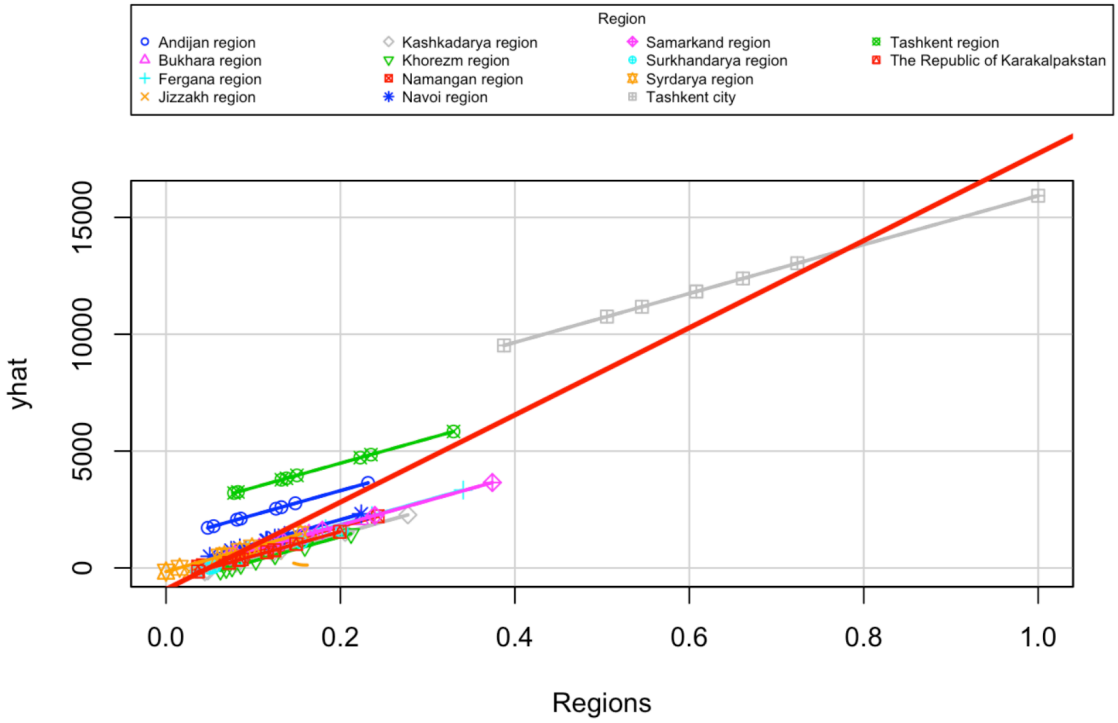
$$TT = -914.80 + 18653.68 \cdot Digix_{it} + u_{it}$$

The summary of the pooled model results shows strong statistical significance. The p-value for the overall model is less than 5%, which is strong evidence against the null hypothesis. Therefore, we can reject the null hypothesis and accept the alternative hypothesis that there is a significant relationship between total trade and the digitalization index. The intercepts are also significant, as their p-values are less than 5%. Moreover, the model explains 83% of the variation in the data, as indicated by the R-squared value. Hence, the model has a high overall accuracy and suitability for explaining the relationship between total trade and digitalization.

However, it is important to note that Pooled regression model ignores heterogeneity between different regions. Despite the high R-squared value and statistically significant p-values, we cannot rely solely on this model because it does not account for the unique characteristics of each region. Consequently, while the pooled model provides a useful initial understanding, it may not fully capture the complexities and variations inherent in the data. To address this, more sophisticated panel data techniques that consider regional heterogeneity should be employed.

*Least Squares Dummy Variable Model (LSDV)*

Here each region is regarded as a dummy variable for estimation. Overall model is good as the p-value is less than 5%. Different regions contribute differently to Total Foreign Trade Turnover, as reflected by the fixed effects. Andijan, Khorezm, Tashkent City, and Tashkent Region, compared to others, have significant impact on Foreign Trade Turnover. Multiple R-squared is 95% which is also more accurate than pooled OLS.




**Graph 3.10 Plot of Each regions model.** Source: Constructed by author

This graph (Graph 3.2.10) includes regression lines for 14 regression models of each region. The redline is the total regression line of LSVD model. The complexity of LSDV increases with the number of parameters, including dummy variables, leading to less efficient estimators. That's why we need to continue with next model.

*Final Model*

Breusch-Pagan test, F test for individual effects and Hausman Test proved that fixed effects model is best estimator, so we can construct a regression model with Time Fixed Effects here:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \delta_2 DummyR + \delta_T DummyT_t + u_{it}$$

This model removes omitted variable bias by removing unobserved variables that change over time but remain constant between entities.

```
## Twoways effects Within Model
##
## Call:
## plm(formula = TT ~ Digix + factor(Year) - 1, data = pdata, effect = "twoways",
##     model = "within", index = c("Region", "Year"))
##
## Balanced Panel: n = 14, T = 8, N = 112
##
## Residuals:
##     Min.  1st Qu.   Median  3rd Qu.     Max.
## -3256.28  -323.53    34.96   355.82  3167.62
##
## Coefficients:
##       Estimate Std. Error t-value  Pr(>|t|)
## Digix  19959.0     2122.2  9.4047 4.946e-15 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    112570000
## Residual Sum of Squares: 56776000
## R-Squared:      0.49565
## Adj. R-Squared: 0.37797
## F-statistic: 88.4481 on 1 and 90 DF, p-value: 4.9456e-15
```

**Graph 3.11 Final model summary.** Source: Constructed by author

The final model is:

$$TT_{it} = \beta_1 \cdot Digix_{it} + \alpha_i + \gamma_t + u_{it}$$

- $TT_{it}$ - it is the dependent variable for region i at time t.
- $\beta_1$ - the coefficient for the variable $Digix_{it}$
- $\alpha_i$ - represents the fixed effect for region i.
- $\gamma_t$ - represents the fixed effect for time t.
- $u_{it}$ - the error term.

$$TT_{it} = 19959.0 \cdot Digix_{it} + \alpha_i + \gamma_t + u_{it}$$

The estimated fixed effects for each region are:

```
fixef(fm)
```

```
##                 Andijan region                 Bukhara region
##                         973.75                        -569.83
##                 Fergana region                Jizzakh region
##                        -867.43                        -376.28
##             Kashkadarya region                Khorezm region
##                        -972.70                        -978.66
##                Namangan region                  Navoi region
##                        -558.02                        -287.40
##               Samarkand region            Surkhandarya region
##                       -1037.76                        -547.66
##                Syrdarya region                 Tashkent city
##                         108.26                         319.41
##                Tashkent region The Republic of Karakalpakstan
##                        1601.92                        -731.40
```

**Graph 3.12 Fixed effects of regions.** Source: Constructed by author

The panel data analysis with two-way fixed effects provides useful insights into the economic variables that has influence on the dependent variable (TT) across different locations and time.

The model shows a strong positive correlation (91%) between the dependent variable (TT) and the digitalization. The estimated coefficient for (Digix) is 19959.0, which is statistically significant ($p < 0.001$).

This coefficient shows how one unit rise in the Digitalization Index (Digix) is expected to impact on region's Foreign Trade Turnover (TT). In other terms, Foreign Trade Turnover of each region will rise by 199.59 million US dollars for every 1 unit improvement in digitization. This indicates that the economic operations associated with international trade within the region benefits greatly from digitalization. Therefore, regions with higher digitalization are likely to witness a considerable boost in their trade activities.

The fixed effects provide these additional details:

- The Tashkent region has a relatively higher fixed effect (1601.92), hence it has a positive impact on the dependent variable beyond the digitalization, and the reason of this might be because Tashkent region is considered as the capital of Uzbekistan and it is more developed than other regions.
- Some regions, such as Fergana, Kashkadarya, and Samarkand, have negative fixed effects. They may experience lower (TT) in the overall trend of (Digix).
- The ($R^2$) value of 0.49565 suggests that the model explains approximately 49.6% of the data.

In conclusion, the results indicate the importance of digitalization (Digix) in foreign trade turnover of regions. This model can be considered while developing strategies to enhance the economic development and well-being of these areas. However, further research may be needed to address the specific challenges and opportunities of each region.

## 3.3 Prospects for increasing the effectiveness of foreign trade activity across the country in the context of digitalization.

Considering the level of digitalization in each region, it is evident that Uzbekistan has a great deal of work to do in order to improve its level of digitalization and effectiveness of foreign trade activities of regions. According to the Decree of The President of Uzbekistan “On Measures to Improve Digital Literacy and Skills in the Workforce”[16], Uzbekistan is taking major steps to create comprehensive training programs to improve digital literacy and skills within population. These programs include gaining knowledge on how to use data analysis tools, digital trading platforms, internet marketing tactics, and cybersecurity measures. Additionally, the "On the Development of Digital Economy and Innovative Technologies"[17] decree is signed to facilitate paperless trade, integrate e-commerce, and streamline customs procedures through online clearing systems in order to improve Uzbekistan's foreign commercial activities in the age of digitization. In order to boost Uzbek exports, the regulation also highlights the significance of digital marketing and promotion. Examples of these efforts include the creation of online marketplaces, the execution of social media campaigns, and participation in virtual trade events.

Despite the government's efforts to improve internet access and digitise government services, the level of digital engagement in Cluster 1 is still low in general. This is can be seen by the low percentage of PCs in organisations and the overall lag in the majority of digitalization-related factors (Graph 3.2). Consequently, raising awareness about the advantages of digitalization for businesses is a key tactic in creating demand for digital transformation, which results in more adoption of digitalization by organisations. Because another potential benefit of digitalization is the improvement of market access through e-commerce platforms. Currently, the limited internet penetration in these regions

[16] 1. PQ-51 No. 01.02.2024.On additional measures to support the training of qualified specialists in the field of digitization. [online] Available at: https://lex.uz/uz/docs/-6786586

[17] 2. PQ-87 No. 26.02.2024. About additional measures to develop the export of services in the field of digitization in our country. [online] Available at: https://lex.uz/uz/docs/-6816000

restricts the ability of local producers to reach global markets directly. Here are the specific recommendations for the regions of Cluster 1 where the primary exports are agricultural products such as fruits, vegetables, and cotton (Namangan, Syrdarya, Fergana, Andijan, Tashkent, Jizzakh and Surkhandarya):

- **Awareness campaigns**: To emphasise the advantages of digital transformation for companies, the government should begin comprehensive awareness initiatives. The campaigns may make use of actual cases as well as success stories from sectors of the economy that have embraced digitalization.
- **Digital Literacy Programs:** Government should implement free and accessible digital literacy programs specifically designed for managers and decision-makers. These programs should cover topics such as e-business, digital marketing, and the use of digital tools to enhance productivity. Singapore's "SMEs Go Digital" program can be a good example. The Infocomm Media Development Authority (IMDA) in Singapore launched the SMEs Go Digital project in April 2017 with the goal of simplifying the digital transition for SMEs. Over 80,000 small and medium-sized enterprises have embraced digital solutions under the initiative[18]. With the help of SMEs Go Digital's CTO-as-a-Service platform, SMEs may evaluate their own level of digital readiness and identify any gaps or needs in their digitization. SMEs may use this platform to get advice on digital solutions to implement, including grant funding that is appropriate for them based on their requirements and business profile. They will be able to evaluate these options side by side and select the one that best suits their requirements. In order to help SMEs benefit from the experiences of their peers, the platform may also give them access to relevant news and case studies of SMEs that have succeeded in going digital.

[18] HELPING SMEs GO DIGITAL About SMEs Go Digital. (2022). Available at: https://www.imda.gov.sg/-/media/Imda/Files/Programme/SMEs-Go-Digital/SMEsGD-Factsheet.pdf.

- **Government Grants and Subsidies**: Startups that concentrate on the digital transformation of organisations should be awarded grants and subsidies. This assistance can aid in the development of creative solutions by these entrepreneurs that improve the usability and accessibility of digital technologies for companies. These digital advancements can result in more digital product exports in addition to improving local business operations. These firms may export their products and services to foreign markets, especially to neighbor countries where there is a good demand for such digital products, as they create innovative software, mobile applications, and other digital solutions. This helps to establish Uzbekistan as a competitive participant in the global digital economy while also diversifying the export portfolio of the regions.
- **Free Wi-Fi in Schools and Lyceums**: Create free Wi-Fi areas in local educational institutions such as lyceums and schools. This programme can encourage the use of digital technologies in school and improve digital literacy from an early age. Finland is a good example to follow as they have implemented a digital education program, called "digital leap", that includes high-speed Internet access in every school[19]. By guaranteeing that every student had access to digital materials, the Finnish government greatly enhanced digital literacy and equipped students for the digital economy.

Although Cluster 2, which includes the Republic of Karakalpakstan, Navoi, Bukhara, Samarkand, Khorezm, and Kashkadarya, is more digitally advanced than Cluster 1, it still confronts multiple challenges. To further strengthen its digitization efforts, Cluster 2 can gain by implementing strategies like to those of Cluster 1 that are listed above. Additionally, economic strategies are needed to increase salaries and attract talented professionals to the information and communication sector as average monthly wage is relatively low. It is necessary

[19] www.oecd-ilibrary.org. (n.d.). Home. [online] Available at: https://www.oecd-ilibrary.org/sites/468e6641-en/index.html?itemId=/content/component/468e6641-en.

to establish innovation hubs or technology centers where entrepreneurs and startups can access resources, mentorship, and networking opportunities to foster digital literacy among entrepreneurs. And to help small and medium-sized businesses (SMEs) expand their reach and attract new clients both locally and globally, offer subsidies or financial incentives for them to implement digital marketing techniques and e-commerce platforms. Besides, the regions in Cluster 2 are popular tourist attractions. Famous for their historical and cultural significance, cities like Bukhara, Samarkand, and Khiva attract large numbers of tourists every year. In these areas, increased digitization may significantly enhance the tourist experience by offering improved information access, online reservation platforms, and digital tours. This can therefore stimulate the travel and tourism industry, increasing international trade as a result of growing consumer demand for travel-related services and goods.

Cluster 3, represented solely by Tashkent city, stands out with the highest levels of digitalization and advanced ICT sector compared to other regions. As the centre of digitalization and communication services in Uzbekistan, Tashkent needs to concentrate on maintaining its position as the leader and promoting continued growth. Firstly, it should prioritize sustained investment in digital infrastructure, which ensures high-speed broadband access, robust network security, and reliable connectivity across all sectors. Secondly, it's essential to support Tashkent's innovation and research and development (R&D) projects. Because, Tashkent may lead the development of cutting-edge technologies such as artificial intelligence, cybersecurity, and IoT by building specialised innovation hubs and research centres, as well as cooperating with universities, entrepreneurs, and business leaders.

In general, the state may encourage the digitialzation of economic processes by taking the following measures:

- increase collaboration of government and educational institutions and concentrate resources to support research and development activities in

important domains, which leads to increased distribution of basic and applied knowledge.

- establishment of an information infrastructure that guarantees the use of public-private partnerships to convert knowledge into a product for the market. It is believed that the state should participate in some aspects of scientific research and the development of information infrastructure, while businesses should handle the majority of market commercialization.
- government should constantly monitor and improve the processes of digitalization to ensure reliability and stability of e-government services
- use data analytics techniques and technology to get insight into public issues, market trends, customer preferences, and supply chain dynamics. By analysing data more efficiently, organisations may make better decisions, optimise their services
- launch awareness campaigns and training programs to increase digital literacy among managers and decision-makers. Highlight the advantages of e-business adoption and share success examples from industries that have embraced digital transformation. Because another major obstacle is a company's level of expertise and experience in this industry. This issue, where managers' "old style" beliefs or a lack of IT specialists prevent them from participating in e-business, and digitalization is common.
- implement extensive training programmes to improve digital literacy and skills in the workforce. This involves learning how to use digital trading platforms, internet marketing strategies, data analysis tools, and cybersecurity precautions. A digitally competent workforce is critical for efficiently utilising digital technology in international commerce activity.
- digitise and automate customs procedures to decrease paperwork, processing delays, and bureaucratic barriers while importing and exporting products. Implementing digital customs clearing systems can increase transparency, lower the risk of corruption, and improve overall trade efficiency.

The major task is to turn the information and communication sector into an effective section of the "knowledge economy" while also employing the republic's research and development sector to effectively carry out national priorities for technological development.

To successfully implement the digital transformation of foreign trade activities, it is important to provide government support to companies: to develop and support a long-term R&D development plan, facilitate the entry of enterprises into foreign markets.

Finally, it is necessary to create a digital ecosystem for the international trade by transforming the entire value chain of R&D, procurement, production, logistics, sales.

## CONCLUSION

The analysis of the development of foreign trade activities of regions in the context of digitalization of international trade carried out in this paper allowed us to draw a number of conclusions that have theoretical and practical significance.

It has been proven that the digitalization of international trade is reflected in the interaction with every actor in the production and consuming processes, particularly at the phases of R&D, marketing, logistics, and so on, within the new digital format of foreign trade activities. From the experience of countries that are leaders in building a digital economy, it is clear that the main factors for success in digital transformation are properly organized government policy. In addition, developed countries are increasing investments in scientific research – sources of "breakthrough" technologies. This should also be taken into account by Uzbekistan, which recognize the digital transformation of sectors as a priority direction of development. The Republic of Uzbekistan has significant potential towards creating a digital economy, the foundation of which are traditional sectors (industry, agro-industrial complex, energy, construction, transport) that provide basic human needs. To maintain competitiveness in the near future, they must receive comprehensive development based on the development and implementation of the latest ICT solutions, which will form a new quality of the industrial basis of the economy.

A classification of the effects of digitalization of international trade has been developed, highlighting various levels, subjects, type of impact and type of resource savings, which ultimately improve the foreign trade activities of countries and regions in the global economy.

Analysis of existing methodological approaches to assess the level of digitalization allowed us to conclude that most of these indices characterize certain areas of development of the digital society, or consider digitalization only at the country level, and therefore it is necessary to investigate a methodological approach capable of assessing the impact of digitalization of international trade on the development of foreign trade activities of regions. Indicators have been

used to measure how digital technologies are used in foreign trade activities by the government, organizations, and individuals. These include a model that shows the connection between digitalization and the volume of exports and imports in a region. Additionally, a new index has been used to evaluate the level of digitalization specifically for regions involved in international trade. This index helps categorize regions based on their digitalization levels.

Implementing the proposed model can enhance the development of foreign trade activities in regions by improving regulatory frameworks for exports and imports, which provides financial assistance to export-oriented organizations, offering organizational support for entering new markets and finding consumers for products. This should be done with the development of the regions' digital infrastructure.

Although this study identifies a regional variation in the digitalization that affect foreign trade turnover of regions, there are significant limitations. Firstly, there is a need for more research because the current studies have not established a common framework to measure the digital economy and there might be discrepancies in the model. Additionally, there is a lack of data in Uzbekistan on the variables that are important to the areas which were hard to find to construct inclusive digitalization index. Besides, the assessment of model was established exclusively using the data, which is limited to Uzbekistan’s regions, and may be less generalizable to other countries.

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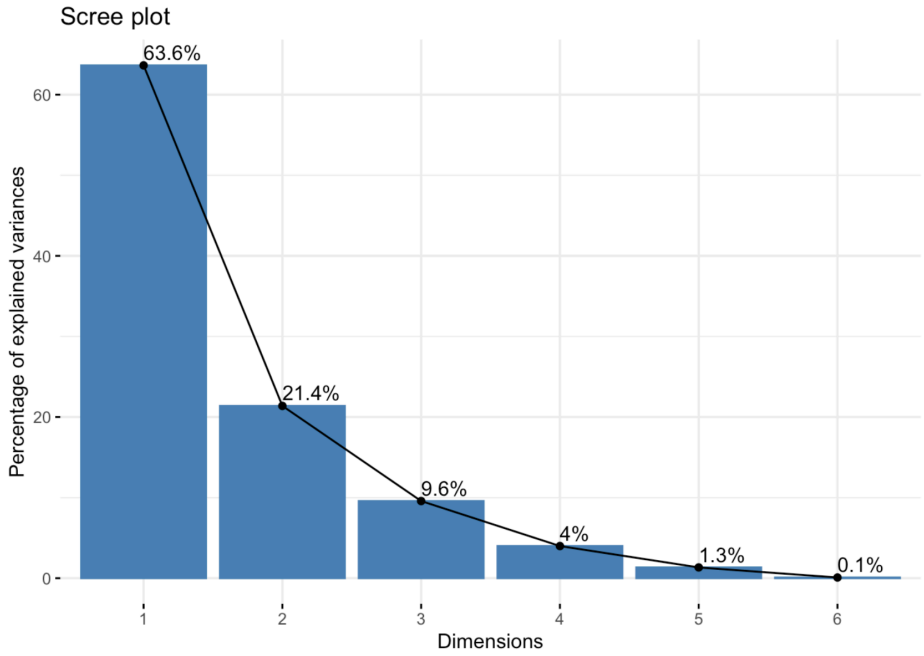
## Appendix 1. Scree plot of PCA analysis.




## Appendix 2. Aggregated information by variables of clusters

```
##   cluster      GCI       IS       APC       NCI       IA       AW      TNRS
## 1       1 127.7102 1727.343  57252.71  29890.29 12.84286 4133.171 1944.571
## 2       2 125.1214 1541.209  67650.83  37061.33 21.36667 4175.209 1779.667
## 3       3 130.1430 5384.981 381051.00 236242.00 28.60000 9148.741 7691.900
##         NRS      NRSI     SHPC      SHLN      NCLN
## 1  74.38571  68.21429 25.34286  3.757143  24126.71
## 2  77.05000  71.76667 40.86667  5.733333  27783.00
## 3 264.40000 157.60000 43.00000 11.300000 233004.00
```

# Appendix 3. The Panel data of Uzbekistan's regions with 17 variables

| Region | Year | Export | Import | GCI | IS | APC | NCI | IA | AW | TT | TB | TNRS | NRS | NRSI | SHPC | SHLN | NCLN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Karakalpakstan** | 2015 | 95,4 | 190,7 | 116 | 501,3 | 32 266 | 9 372 | 22,2 | 1 132,60 | 286,1 | -95,3 | 1202,7 | 67,7 | 66,2 | 40,6 | 4 | 10864 |
| **Karakalpakstan** | 2016 | 428,3 | 200,1 | 106,1 | 526,4 | 36 322 | 10 692 | 23,9 | 1 276,50 | 628,4 | 228,2 | 1201,9 | 66,6 | 65,4 | 50,9 | 4,5 | 12260 |
| **Karakalpakstan** | 2017 | 462,4 | 178,7 | 116,2 | 606,8 | 41 125 | 12 594 | 25 | 1 552,60 | 641,1 | 283,7 | 1295,8 | 70,8 | 69,6 | 53,9 | 4,9 | 14379 |
| **Karakalpakstan** | 2018 | 457,8 | 284,2 | 105,3 | 767,9 | 45 483 | 15 431 | 24,9 | 1 948,90 | 742 | 173,6 | 1262,7 | 68 | 66,6 | 59,9 | 4,6 | 16216 |
| **Karakalpakstan** | 2019 | 431,1 | 268,9 | 112,2 | 922,3 | 50 945 | 17 788 | 24,7 | 2 322,30 | 700 | 162,2 | 1332,2 | 70,7 | 68,6 | 64,7 | 4,5 | 18852 |
| **Karakalpakstan** | 2020 | 362,7 | 176,3 | 107,8 | 1 071,90 | 53 251 | 21 882 | 19,7 | 2 437,00 | 539 | 186,4 | 1377,7 | 72,1 | 69,9 | 72,2 | 2,9 | 17761 |
| **Karakalpakstan** | 2021 | 416,2 | 233 | 114,6 | 1 234,20 | 55 510 | 23 958 | 18,9 | 2 841,40 | 649,2 | 183,2 | 1427,4 | 73,7 | 70,2 | 54,2 | 2,5 | 19558 |
| **Karakalpakstan** | 2022 | 352,8 | 246,5 | 120,4 | 1 346,60 | 57 498 | 31 555 | 18,7 | 3 681,50 | 599,3 | 106,3 | 1499,3 | 76,4 | 71,9 | 36,2 | 5,7 | 28019 |
| **Andijan** | 2015 | 206,6 | 1358,1 | 115,5 | 621,5 | 40 545 | 7 950 | 11 | 1 004,70 | 1564 | -1151,5 | 1747,3 | 60,6 | 59,7 | 34,6 | 1,8 | 11658 |
| **Andijan** | 2016 | 266,1 | 836,6 | 106,2 | 731,1 | 43 211 | 8 839 | 12,8 | 1 029,40 | 1102 | -570,5 | 1806,3 | 61,5 | 60,7 | 37,7 | 1,9 | 12733 |
| **Andijan** | 2017 | 398,7 | 1198,1 | 114 | 842 | 46 409 | 11 972 | 18,4 | 1 294,40 | 1596 | -799,4 | 1904,3 | 63,8 | 62,9 | 40,1 | 2,7 | 14187 |
| **Andijan** | 2018 | 357 | 1819,4 | 106,9 | 991,3 | 48 895 | 14 699 | 18,1 | 1 779,10 | 2176 | -1462,4 | 1829,8 | 60,2 | 59,3 | 43,1 | 2,3 | 15419 |
| **Andijan** | 2019 | 499,6 | 2033,2 | 113,6 | 1 236,50 | 54 530 | 17 830 | 21,5 | 2 138,50 | 2532 | -1533,6 | 2003,4 | 64,7 | 63,6 | 48,8 | 3,1 | 18510 |
| **Andijan** | 2020 | 584,1 | 2211,3 | 113 | 1 484,20 | 56 344 | 20 173 | 16,1 | 2 278,00 | 2795 | -1627,2 | 2166,9 | 68,6 | 67,3 | 50,2 | 2,2 | 17639 |
| **Andijan** | 2021 | 978,9 | 2186,5 | 112,7 | 1 790,60 | 53 842 | 22 450 | 11,4 | 2 824,20 | 3165 | -1207,6 | 2498,4 | 77,6 | 67,9 | 35,8 | 1,3 | 16291 |
| **Andijan** | 2022 | 1246 | 3036 | 129,5 | 2 019,80 | 56 854 | 26 791 | 11,6 | 3 713,60 | 4282 | -1789,5 | 2696,3 | 82 | 70,9 | 25,6 | 2,8 | 27174 |
| **Bukhara** | 2015 | 321,5 | 601,3 | 119,6 | 430,9 | 36 642 | 9 963 | 26,1 | 1 117,40 | 922,8 | -279,8 | 1182,9 | 65,7 | 63,9 | 50,9 | 4,5 | 10447 |
| **Bukhara** | 2016 | 261,9 | 453,6 | 107,9 | 482,6 | 39 506 | 12 565 | 30,7 | 1 135,30 | 715,5 | -191,7 | 1210,5 | 66,2 | 64,4 | 55,8 | 5,7 | 11429 |
| **Bukhara** | 2017 | 201,7 | 676,2 | 116 | 547,3 | 41 003 | 14 073 | 30 | 1 405,50 | 877,9 | -474,5 | 1253,5 | 67,5 | 65,6 | 55,8 | 4,8 | 12087 |
| **Bukhara** | 2018 | 187,2 | 724,2 | 110,4 | 694 | 45 294 | 16 041 | 29,7 | 1 819,90 | 911,4 | -537 | 1247,6 | 66,4 | 64,5 | 59,9 | 5,7 | 13439 |
| **Bukhara** | 2019 | 265,8 | 993,6 | 110,5 | 855,2 | 51 280 | 19 513 | 27,5 | 2 216,90 | 1259 | -727,8 | 1350,5 | 70,7 | 68 | 62,5 | 5,3 | 13129 |
| **Bukhara** | 2020 | 231,1 | 600,1 | 107,4 | 1 011,20 | 55 888 | 23 101 | 21,7 | 2 594,70 | 831,2 | -369 | 1404,8 | 72,6 | 70,1 | 64 | 4,1 | 15796 |
| **Bukhara** | 2021 | 312,1 | 868,8 | 118,8 | 1 204,50 | 56 058 | 28 666 | 17,4 | 3 018,30 | 1181 | -556,7 | 1488,8 | 75,9 | 72,1 | 51,6 | 3,2 | 18689 |
| **Bukhara** | 2022 | 306,5 | 918,2 | 122,7 | 1 383,00 | 59 794 | 33 826 | 17,2 | 4 289,20 | 1224 | -611,7 | 1547,6 | 77,6 | 73,5 | 39,5 | 5 | 22778 |
| **Jizzakh** | 2015 | 89,9 | 68,4 | 119,8 | 270,9 | 21 682 | 9 257 | 19,2 | 1 164,20 | 158,3 | 21,5 | 727,7 | 57,6 | 56,7 | 33 | 7,7 | 12842 |
| **Jizzakh** | 2016 | 121,2 | 73,4 | 108,2 | 304,4 | 23 457 | 11 796 | 23 | 1 234,60 | 194,6 | 47,8 | 746,6 | 57,9 | 57,2 | 35,3 | 8,4 | 14069 |
| **Jizzakh** | 2017 | 116,4 | 118,7 | 118,7 | 371,3 | 25 854 | 12 822 | 20,8 | 1 481,70 | 235,1 | -2,3 | 777,9 | 59,2 | 58,3 | 32,3 | 7,4 | 15269 |
| **Jizzakh** | 2018 | 76,2 | 260 | 105,4 | 468,2 | 26 976 | 14 200 | 19,2 | 1 897,10 | 336,2 | -183,8 | 782,8 | 58,5 | 57,3 | 30,8 | 7,2 | 16401 |
| **Jizzakh** | 2019 | 120,3 | 388,6 | 110,8 | 569,1 | 28 867 | 14 822 | 19,2 | 2 022,80 | 508,9 | -268,3 | 838,3 | 61,3 | 59,3 | 30,6 | 5,6 | 14794 |
| **Jizzakh** | 2020 | 124,1 | 692,5 | 119 | 667,2 | 18 887 | 9 251 | 15,1 | 2 812,30 | 816,6 | -568,4 | 917,1 | 65,7 | 63,6 | 29,8 | 2,9 | 6599 |
| **Jizzakh** | 2021 | 195,5 | 335,7 | 129,4 | 794,1 | 34 016 | 19 924 | 10,3 | 3 650,80 | 531,2 | -140,2 | 958,5 | 67,2 | 64,4 | 27,4 | 2,7 | 14553 |
| **Jizzakh** | 2022 | 199,7 | 488,5 | 125,5 | 895,9 | 34 820 | 20 314 | 7,6 | 4 696,50 | 688,2 | -288,8 | 1027,1 | 70,4 | 66,9 | 15 | 2,5 | 15639 |
| **Kashkadarya** | 2015 | 269,7 | 468 | 120,8 | 489,3 | 48 070 | 6 430 | 13,1 | 1 032,40 | 737,7 | -198,3 | 1566 | 52,3 | 51,1 | 36,7 | 2,5 | 10520 |
| **Kashkadarya** | 2016 | 239 | 525,1 | 110,5 | 578,5 | 55 820 | 11 491 | 20,1 | 1 116,80 | 764,1 | -286,1 | 1581,4 | 51,7 | 50,6 | 53,3 | 3,3 | 13776 |
| **Kashkadarya** | 2017 | 226,3 | 370,6 | 111,2 | 702,5 | 59 141 | 13 179 | 20,5 | 1 391,70 | 596,9 | -144,3 | 1687,4 | 54,1 | 52,7 | 57,5 | 5,2 | 18690 |
| **Kashkadarya** | 2018 | 270,8 | 495 | 108 | 877,8 | 64 395 | 14 857 | 20,1 | 1 794,30 | 765,8 | -224,2 | 1692,3 | 53,2 | 51,8 | 64,4 | 4,8 | 19883 |
| **Kashkadarya** | 2019 | 366,1 | 458,7 | 113 | 1 162,40 | 67 670 | 18 006 | 18,7 | 2 194,60 | 824,8 | -92,6 | 1857,8 | 57,2 | 55,8 | 60,7 | 4,7 | 21972 |
| **Kashkadarya** | 2020 | 195,4 | 346,8 | 111,6 | 1 440,90 | 62 434 | 18 631 | 14,9 | 2 529,80 | 542,2 | -151,4 | 1996,8 | 60,4 | 59 | 61,9 | 3,2 | 16591 |
| **Kashkadarya** | 2021 | 270 | 295,7 | 121,8 | 1 696,20 | 74 842 | 27 573 | 14 | 3 155,90 | 565,7 | -25,7 | 2068,2 | 61,3 | 60,3 | 51,8 | 2,2 | 15680 |
| **Kashkadarya** | 2022 | 301,1 | 244,3 | 126,9 | 1 905,50 | 83 838 | 43 673 | 22,2 | 3 909,10 | 545,4 | 56,8 | 2207,2 | 64,1 | 61,7 | 34,5 | 6,6 | 34878 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Navoi** | 2015 | 441,4 | 361 | 118,9 | 276,2 | 30 709 | 8 516 | 30,7 | 1 109,50 | 802,4 | 80,4 | 738,9 | 80,3 | 76,3 | 50 | 4,9 | 11345 |
| **Navoi** | 2016 | 356 | 348 | 107,8 | 312,7 | 33 951 | 10 403 | 34,1 | 1 159,00 | 704 | 8 | 754,3 | 80,7 | 76,9 | 53,6 | 5,6 | 13031 |
| **Navoi** | 2017 | 302,5 | 466,4 | 115,5 | 350,4 | 35 646 | 11 190 | 33 | 1 447,10 | 768,9 | -163,9 | 776,7 | 81,7 | 77,9 | 49,1 | 5,3 | 14453 |
| **Navoi** | 2018 | 350,2 | 1286 | 107,3 | 442,5 | 40 031 | 14 490 | 42,5 | 1 870,00 | 1636 | -935,8 | 785,2 | 80,8 | 76,3 | 59,4 | 5,5 | 16396 |
| **Navoi** | 2019 | 362,9 | 1472,5 | 109,9 | 553,8 | 44 562 | 17 686 | 35,3 | 2 068,60 | 1835 | -1109,6 | 850,8 | 86,1 | 80,9 | 57,2 | 4,7 | 18794 |
| **Navoi** | 2020 | 426,5 | 885,8 | 112,5 | 647,1 | 46 708 | 18 246 | 31,9 | 2 538,80 | 1312 | -459,3 | 915,4 | 91 | 86,4 | 68 | 3,2 | 18229 |
| **Navoi** | 2021 | 508,6 | 659,9 | 113,7 | 761,8 | 48 364 | 21 025 | 25,3 | 3 090,20 | 1168 | -151,3 | 944,3 | 92,2 | 86,6 | 54,1 | 2,5 | 21298 |
| **Navoi** | 2022 | 581 | 649,4 | 126,2 | 876,4 | 54 277 | 28 631 | 29,4 | 4 106,70 | 1230 | -68,4 | 1027,5 | 98,4 | 89,3 | 48,9 | 7,5 | 25993 |
| **Namangan** | 2015 | 112,1 | 161,1 | 119,8 | 523,5 | 35 504 | 6 615 | 12,3 | 1 032,00 | 273,2 | -49 | 1484 | 57,5 | 56,6 | 33,5 | 4,6 | 13376 |
| **Namangan** | 2016 | 159,2 | 322,9 | 107,7 | 621,4 | 39 880 | 8 942 | 17,9 | 1 164,20 | 482,1 | -163,7 | 1546,5 | 58,8 | 58,1 | 41,8 | 5,7 | 16246 |
| **Namangan** | 2017 | 196,7 | 377 | 120,7 | 749,8 | 42 643 | 10 499 | 19 | 1 394,90 | 573,7 | -180,3 | 1671,4 | 62,5 | 61,6 | 40,9 | 4,5 | 17954 |
| **Namangan** | 2018 | 247,4 | 955,1 | 107 | 961,5 | 47 299 | 13 800 | 23,2 | 1 934,60 | 1202 | -707,7 | 1651,4 | 60,6 | 59,5 | 51,3 | 5,6 | 20143 |
| **Namangan** | 2019 | 356 | 630,5 | 110,6 | 1 198,30 | 52 800 | 17 292 | 23,3 | 2 397,90 | 986,5 | -274,5 | 1831,1 | 65,8 | 64,5 | 53,4 | 5,5 | 21942 |
| **Namangan** | 2020 | 380,5 | 493,4 | 109,7 | 1 379,50 | 55 071 | 20 408 | 20 | 2 427,40 | 873,9 | -112,9 | 1941,2 | 68,4 | 67,1 | 56,1 | 3,5 | 19748 |
| **Namangan** | 2021 | 496,2 | 594,8 | 110,2 | 1 637,00 | 57 102 | 22 960 | 15,1 | 2 945,90 | 1091 | -98,6 | 2212,3 | 76,3 | 68,7 | 47 | 2,33 | 19135 |
| **Namangan** | 2022 | 584,4 | 695,2 | 128,7 | 1 863,90 | 60 058 | 34 032 | 18,9 | 3 675,30 | 1279 | -110,8 | 2386,3 | 80,5 | 71,3 | 31,6 | 5,3 | 21840 |
| **Samarkand** | 2015 | 232,7 | 677,9 | 121,8 | 758,2 | 58 169 | 12 803 | 16,2 | 943 | 910,6 | -445,2 | 1972,6 | 55,6 | 54,9 | 58,1 | 4,6 | 18058 |
| **Samarkand** | 2016 | 259,2 | 726,1 | 111 | 865 | 63 415 | 16 775 | 21,7 | 1 063,20 | 985,3 | -466,9 | 2023,4 | 55,9 | 55,3 | 70,9 | 6,6 | 21358 |
| **Samarkand** | 2017 | 259,9 | 841,7 | 121,5 | 1 018,70 | 69 606 | 23 569 | 22,3 | 1 303,70 | 1101 | -581,8 | 2109,3 | 57,2 | 56,6 | 66,5 | 6,1 | 25432 |
| **Samarkand** | 2018 | 315,6 | 1304,9 | 108,8 | 1 225,70 | 79 084 | 26 955 | 22,3 | 1 557,60 | 1620 | -989,3 | 2095,9 | 55,7 | 54,9 | 77,4 | 5,9 | 26937 |
| **Samarkand** | 2019 | 398,5 | 1351,4 | 112,7 | 1 505,90 | 87 599 | 32 001 | 20,8 | 1 894,80 | 1749 | -952,9 | 2263,3 | 59 | 57,7 | 77 | 6 | 30913 |
| **Samarkand** | 2020 | 335,2 | 1156,4 | 111,1 | 1 795,40 | 86 409 | 33 970 | 17,9 | 2 410,80 | 1491 | -821,2 | 2449,7 | 62,6 | 61,1 | 79,7 | 3,4 | 21280 |
| **Samarkand** | 2021 | 531,7 | 1388,8 | 115,2 | 2 132,50 | 91 490 | 39 367 | 14,3 | 3 438,20 | 1920 | -857,1 | 2774,2 | 69,5 | 62,7 | 60 | 2,2 | 25093 |
| **Samarkand** | 2022 | 636,6 | 1729 | 126 | 2 407,40 | 96 740 | 58 895 | 22,9 | 5 023,40 | 2365 | -1092,4 | 2993,5 | 73,5 | 64,8 | 43 | 4,7 | 35354 |
| **Surkhandarya** | 2015 | 213,8 | 50,9 | 121,1 | 372,2 | 34 623 | 4 728 | 17,7 | 1 054,10 | 264,7 | 162,9 | 1201,8 | 50,4 | 49,6 | 38,7 | 5,3 | 10778 |
| **Surkhandarya** | 2016 | 148,2 | 122,5 | 109,3 | 433,5 | 35 976 | 5 561 | 17,9 | 1 124,00 | 270,7 | 25,7 | 1234,2 | 50,6 | 49,9 | 37,8 | 5,4 | 11953 |
| **Surkhandarya** | 2017 | 157,4 | 217,2 | 111,9 | 551,5 | 38 829 | 6 907 | 17,2 | 1 426,30 | 374,6 | -59,8 | 1327 | 53,3 | 52,6 | 34,2 | 7,6 | 19315 |
| **Surkhandarya** | 2018 | 191,7 | 397,3 | 109,8 | 721,4 | 41 879 | 8 611 | 16,9 | 1 896,20 | 589 | -205,6 | 1313,7 | 51,7 | 50,7 | 40,7 | 7,6 | 21682 |
| **Surkhandarya** | 2019 | 241 | 321,7 | 110,4 | 958,6 | 40 781 | 9 323 | 13,3 | 2 208,30 | 562,7 | -80,7 | 1457,5 | 56,1 | 54,9 | 35,9 | 5,3 | 18151 |
| **Surkhandarya** | 2020 | 213,5 | 203,4 | 109,7 | 1 151,50 | 27 291 | 8 840 | 8,5 | 2 743,70 | 416,9 | 10,1 | 1515,6 | 57,1 | 55,9 | 30,9 | 1,6 | 7830 |
| **Surkhandarya** | 2021 | 235,2 | 207,3 | 121,2 | 1 323,50 | 36 280 | 14 509 | 8 | 3 945,60 | 442,5 | 27,9 | 1608,4 | 59,3 | 56,9 | 24,9 | 1,9 | 7793 |
| **Surkhandarya** | 2022 | 227,4 | 145,2 | 127,5 | 1 538,20 | 43 739 | 24 329 | 7,9 | 4 093,50 | 372,6 | 82,2 | 1762,2 | 63,5 | 60,5 | 15,7 | 2,4 | 14570 |
| **Syrdarya** | 2015 | 140,6 | 134,6 | 111,6 | 212,4 | 17 331 | 3 961 | 17,7 | 1 216,50 | 275,2 | 6 | 523,6 | 66,8 | 66,1 | 36,2 | 4,1 | 5777 |
| **Syrdarya** | 2016 | 114 | 138,2 | 107,9 | 229,8 | 18 737 | 4 542 | 19,6 | 1 265,30 | 252,2 | -24,2 | 524,3 | 65,8 | 65,2 | 37,1 | 4,4 | 6945 |
| **Syrdarya** | 2017 | 144,6 | 144,6 | 115,1 | 284,6 | 20 254 | 5 488 | 20,2 | 1 528,30 | 289,2 | 0 | 589,7 | 72,9 | 72 | 38,1 | 4,1 | 6877 |
| **Syrdarya** | 2018 | 119,1 | 172,3 | 104,2 | 349,1 | 21 660 | 6 327 | 19,8 | 1 353,50 | 291,4 | -53,2 | 554,6 | 67,4 | 66,5 | 40,4 | 4,2 | 7629 |
| **Syrdarya** | 2019 | 131,8 | 439 | 112,3 | 441,4 | 23 669 | 7 849 | 19,7 | 2 004,60 | 570,8 | -307,2 | 593,3 | 70,8 | 68,9 | 41,3 | 3,4 | 7496 |
| **Syrdarya** | 2020 | 179,7 | 433 | 120,5 | 505,7 | 24 435 | 10 245 | 19,1 | 2 460,10 | 612,7 | -253,3 | 614,6 | 72 | 70,1 | 44 | 2,9 | 8011 |
| **Syrdarya** | 2021 | 233,9 | 433,2 | 114,5 | 595,4 | 24 286 | 12 753 | 14,2 | 2 926,00 | 667,1 | -199,3 | 705,1 | 81,1 | 72,2 | 41 | 2,5 | 8229 |
| **Syrdarya** | 2022 | 327,6 | 486 | 127,8 | 673 | 27 876 | 13 705 | 14,2 | 3 938,80 | 813,6 | -158,4 | 729,7 | 82,2 | 75,9 | 27,5 | 3,7 | 11758 |
| **Tashkent** | 2015 | 1637 | 1457,7 | 119,9 | 273,6 | 53 402 | 12 695 | 18,9 | 1 106,20 | 3094 | 179,4 | 560,2 | 20,2 | 19,1 | 39,7 | 3,1 | 15590 |
| **Tashkent** | 2016 | 1103 | 1916,8 | 117,8 | 353,1 | 57 984 | 15 484 | 24,2 | 1 261,00 | 3019 | -813,7 | 589,8 | 21 | 19,7 | 47 | 3,5 | 17189 |
| **Tashkent** | 2017 | 1406 | 1801,6 | 129,8 | 352,3 | 60 492 | 18 371 | 25,4 | 1 770,30 | 3207 | -395,6 | 607,6 | 21,4 | 20,3 | 43,9 | 3,6 | 18483 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tashkent** | 2018 | 1535 | 2325,9 | 123,7 | 506,7 | 68 944 | 23 393 | 25,8 | 2 272,70 | 3861 | -790,5 | 662,5 | 23 | 22 | 46,6 | 4,5 | 22181 |
| **Tashkent** | 2019 | 1781 | 2965,3 | 107,9 | 1 007,70 | 78 495 | 29 228 | 25,4 | 2 214,60 | 4746 | -1183,7 | 1191,6 | 40,8 | 38,4 | 47,4 | 4,2 | 25831 |
| **Tashkent** | 2020 | 1786 | 2818,1 | 143,1 | 1 255,20 | 81 215 | 36 050 | 19,4 | 2 181,80 | 4604 | -1032 | 1405,1 | 47,6 | 45 | 45,2 | 3,4 | 27305 |
| **Tashkent** | 2021 | 2011 | 3300,2 | 130,9 | 1 483,80 | 86 668 | 45 031 | 16,7 | 3 060,30 | 5311 | -1289,1 | 1672 | 57,4 | 50,9 | 39,5 | 2,9 | 31448 |
| **Tashkent** | 2022 | 2042 | 3542,1 | 128,5 | 1 688,80 | 91 942 | 52 032 | 17 | 4 627,40 | 5584 | -1499,7 | 1779,7 | 60 | 54,2 | 30,7 | 5,9 | 39578 |
| **Fergana** | 2015 | 381,8 | 786,1 | 115,5 | 751,9 | 49 112 | 10 833 | 17,4 | 1 020,40 | 1167 | -404,3 | 2159,4 | 62,1 | 60,6 | 46 | 3,6 | 16758 |
| **Fergana** | 2016 | 395,2 | 478 | 110,4 | 881,4 | 52 846 | 14 035 | 21,8 | 1 101,60 | 873,2 | -82,8 | 2229,6 | 63,1 | 61,7 | 50,9 | 5 | 21593 |
| **Fergana** | 2017 | 514 | 435,4 | 113 | 1 048,00 | 55 249 | 15 489 | 20,6 | 1 474,20 | 949,4 | 78,6 | 2333,8 | 65 | 63,6 | 47,3 | 4,6 | 22720 |
| **Fergana** | 2018 | 484,3 | 869,3 | 109,4 | 1 245,50 | 62 401 | 18 449 | 20,8 | 1 895,40 | 1353 | -385 | 2333,8 | 63,9 | 62,5 | 56,4 | 4,7 | 24425 |
| **Fergana** | 2019 | 574,4 | 843,4 | 109,2 | 1 552,30 | 66 245 | 21 508 | 19,2 | 2 232,50 | 1417 | -269 | 2578,3 | 69,4 | 67,7 | 54,3 | 4,1 | 23244 |
| **Fergana** | 2020 | 556,1 | 907 | 114,9 | 1 937,40 | 79 718 | 27 590 | 16,5 | 2 472,20 | 1463 | -350,9 | 2858,9 | 75,5 | 74 | 57,4 | 2,5 | 21269 |
| **Fergana** | 2021 | 801,3 | 1034,3 | 116,9 | 2 872,30 | 84 188 | 32 638 | 15,7 | 2 940,30 | 1835 | -233 | 3026,2 | 78,4 | 73,4 | 45,9 | 2 | 23111 |
| **Fergana** | 2022 | 829,3 | 1234,6 | 126,1 | 3 411,70 | 85 480 | 38 029 | 12,7 | 4 187,00 | 2063 | -405,3 | 3230,7 | 82,1 | 77,8 | 31,3 | 3,7 | 38328 |
| **Khorezm** | 2015 | 111,4 | 100 | 124 | 391,8 | 30 640 | 7 533 | 20,5 | 992,4 | 211,4 | 11,4 | 1064,6 | 61,5 | 60,4 | 40,7 | 3,7 | 9761 |
| **Khorezm** | 2016 | 95,6 | 121 | 108,5 | 448,5 | 33 601 | 8 578 | 23,8 | 1 100,20 | 216,6 | -25,4 | 1084,3 | 61,5 | 60,8 | 46,3 | 4,2 | 11407 |
| **Khorezm** | 2017 | 122,7 | 133,3 | 114,4 | 573,3 | 36 675 | 9 410 | 25,5 | 1 375,90 | 256 | -10,6 | 1180,1 | 65,9 | 65 | 46,9 | 4,3 | 12790 |
| **Khorezm** | 2018 | 102,1 | 170 | 106,7 | 710,2 | 40 212 | 11 962 | 27,2 | 1 779,70 | 272,1 | -67,9 | 1144,1 | 62,9 | 61,9 | 59,1 | 5,3 | 14686 |
| **Khorezm** | 2019 | 146,9 | 410,8 | 109,9 | 872,1 | 45 094 | 14 811 | 27,4 | 2 076,00 | 557,7 | -263,9 | 1227,3 | 66,3 | 64,9 | 61,7 | 4,6 | 15130 |
| **Khorezm** | 2020 | 169,6 | 299,7 | 112,7 | 1 012,90 | 47 518 | 17 600 | 24,9 | 2 408,80 | 469,3 | -130,1 | 1281,5 | 68,2 | 66,7 | 70,8 | 3,2 | 15247 |
| **Khorezm** | 2021 | 231,2 | 286 | 118,3 | 1 185,90 | 50 746 | 20 297 | 21,6 | 2 964,80 | 517,2 | -54,8 | 1315,2 | 68,9 | 67 | 58 | 2,3 | 16620 |
| **Khorezm** | 2022 | 247 | 540,3 | 128,3 | 1 328,40 | 53 758 | 25 788 | 17,8 | 4 041,40 | 787,3 | -293,3 | 1402,9 | 72,3 | 69,4 | 43,1 | 4,9 | 19676 |
| **Tashkent city** | 2015 | 2653 | 5667,6 | 112,1 | 2 465,30 | 245 874 | 113 251 | 37,7 | 2 256,00 | 8321 | -3013,7 | 4534,4 | 190 | 182 | 55,4 | 7 | 12958 |
| **Tashkent city** | 2016 | 2563 | 5552,6 | 121,7 | 2 858,30 | 266 061 | 131 654 | 42,8 | 2 650,60 | 8116 | -2988,7 | 4732,3 | 196 | 190 | 57,4 | 7,3 | 14147 |
| **Tashkent city** | 2017 | 2711 | 5728,8 | 127,5 | 3 169,70 | 280 899 | 144 896 | 44,5 | 3 181,70 | 8440 | -3017 | 4990 | 204 | 197 | 60,3 | 7,1 | 15174 |
| **Tashkent city** | 2018 | 2903 | 6896,1 | 123,5 | 3 359,90 | 297 347 | 158 788 | 43,2 | 4 212,70 | 9799 | -3992,3 | 4598,1 | 184 | 178 | 60,3 | 8,8 | 16605 |
| **Tashkent city** | 2019 | 3187 | 10041 | 105,8 | 3 550,60 | 320 189 | 175 760 | 39,5 | 4 953,00 | 13229 | -6854,3 | 4471,3 | 176 | 166 | 70 | 7,9 | 16811 |
| **Tashkent city** | 2020 | 2923 | 9436,9 | 132 | 4 620,90 | 319 517 | 175 926 | 30,7 | 5 512,00 | 12360 | -6513,7 | 5126 | 194 | 155 | 58,6 | 6,8 | 16323 |
| **Tashkent city** | 2021 | 3847 | 12735 | 132,5 | 4 275,40 | 352 751 | 207 782 | 25,7 | 6 851,20 | 16583 | -8888,3 | 6323,4 | 224 | 154 | 48,2 | 5,7 | 18406 |
| **Tashkent city** | 2022 | 4669 | 14939 | 130,1 | 5 385,00 | 381 051 | 236 242 | 28,6 | 9 148,70 | 19609 | -10270 | 7691,9 | 264 | 157 | 43 | 11,3 | 23300 |