

## The Impact of the Digitalization Process and Investment on the Structural Changes of the Economy

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### Abstract

*This article analyzes the impact of digitalization on the structural changes of the economy on the example of Uzbekistan. The degree of effectiveness of the investment factor in such circumstances is also considered. The research work of a number of scientists has been studied and the necessary aspects for research have been presented. The main factor determining the level of digitalization is the gross value added of the digital economy to GDP. The next factor influencing structural change is the inflow of investment in fixed assets. An econometric analysis was performed to determine the relationship between the factors and a conclusion was drawn based on the results. The study was conducted for the period 2016-2020 of the Uzbekistan's economy. The article also theoretically explores and analyzes structural changes in the economy, its impact on economic development, factors influencing structural changes, and the impact of investment flows on the economy and structural changes. The study found a strong correlation between GDP and gross value added in the ICT sector. In addition, the analysis found that investment has a positive effect on structural changes, as a result of increased investment in fixed assets increases both the volume of GDP and the level of structural change.*

**Key-words:** Structural Changes, Investment Flows, Digital Services, ICT (Information and Communication Technologies), GDP, Digital Economy, Investment Climate, Investment Attractiveness, Foreign Investment, Economic Structure, Industry, Services, Agriculture, Construction.

## **1. Introduction**

The world economy is changing a lot today. One of the main changes is the structure of the economy. The reason for this change is the emergence of an innovative approach to the economy. In general, the structure of demand in the world today is changing. Various manufacturing and service enterprises and companies are adapting their activities to the needs of the population. As a result, on the one hand, it leads to structural changes in the economy, and on the other hand, it creates more conveniences for the population. The advent of digital technology and increased investment flows have also accelerated the process. This process is being carried out in Uzbekistan as well. While the country was an agrarian-industrial economy at the time of independence, it was able to join the ranks of industrial-agrarian economies as a result of post-independence reforms. Today, the share of the services sector in the country's economy is high, and the share of digital technologies in the economy is growing. The acceleration of the digitalization process in the economy will lead to structural changes, and the impact of the investment factor will lead to further refinement and complication of this process. In addition, the growing global investment flows are having a major impact on the world's economies. As a result of the increase in direct investment, the real sector of the country is developing and production is growing. This directly leads to an increase in the volume of industrial output in the economy and an increase in the share of industry in the economy. The development of the services sector will also be positively influenced by the increase in investment inflows into the country.

Based on the above, it is important for the Uzbekistan's economy today to determine the impact of the digitalization process on the structural changes in the economy, to develop indicators for the development of the digital economy and to assess the impact of the investment factor on the economy.

## **2. Literature Review**

A lot of scientists have conducted a number of studies in different countries and periods on the structural changes in the economy, the impact of digitalization on this process and the impact of investment on the economy.

According to research by Geoff Riley, economic structure (structure, content) is a term that describes the changing balance of output, trade, income, and employment that comes from different economic sectors. These changes range from primary (agriculture, fisheries, mining, etc.) to

secondary (manufacturing and construction) and from the third and fourth levels (tourism, banking, software) includes changes to. Changes in economic structure are a natural state of economic development, but they can present difficulties in terms of redistribution of factors of production. For example, changes in production and jobs in a single industry can lead to structural unemployment problems [1].

According to Akhilesh Ganti [2], “structural changes in the economy usually mean drastic changes in industrial or market functions resulting from large-scale economic development” [3]. As a result of this research, the following hypotheses were developed:

- Structural change refers to abrupt changes in a country’s, industry, or market activity that usually lead to major economic growth.
- The key to structural change is the dynamism inherent in this system.
- Structural changes are often caused by technological innovations, new economic developments, global changes in capital and labor, changes in the availability of resources, changes in supply and demand for resources, and changes in the political landscape.

Scholars Cong Wang and Yifan Lu published an article entitled “Can economic structural change and transition explain cross-country differences in innovative activity?” [4]. In this paper, the scientists analyzed the impact of structural changes on innovation, based on a combination of Schumpeter’s views on innovation and Kuznets’s theory of structural change introduced by Quatraro (2009) [5]. The global sample for this study is the economies of 75 developed and developing countries from 1970 to 2012. Scientists have found that the share of the service sector has a positive effect on innovation and the share of agriculture has a negative effect on innovation. They also find that these effects vary in different economies, which differ in income and structural transitions. In particular, while moving away from agriculture is important for the economies of developed countries, the industrial sector is important for innovation in countries with above-average incomes. Countries with low-income economies benefit less from structural changes in their economies than countries with low-middle, high-middle, and high-income economies.

Francesco Quatraro published an article in the Cambridge Journal of Economics entitled “Innovation, structural change and productivity growth: evidence from Italian regions” [6]. In his article, the scientist developed and analyzed Schumpeter’s theory of structural change by linking the role of business cycles and creative destruction to the theory of growth retardation. The scientist studied 20 regions of Italy based on the knowledge economy between 1981 and 2003. The results show that the transition to a fully knowledgeable economy is required in the first industrialized regions. In the late industrialized regions, on the other hand, there is an increase in productivity in the

manufacturing sector due to the delayed expansion of production activities, and innovations occur directly within production.

In addition, Jaime Alonso-Carrera and Xavier Raurich in their article “Labor mobility, structural change and economic growth” [7], Naohisa Hirakata and Takeki Sunakawa in their article “Financial frictions, capital misallocation and structural change”, Lucas Hardt, John Barrett, Peter G. Taylor and Timothy J. Foxon in their article “What structural change is needed for a post-growth economy: A framework of analysis and empirical evidence” [8], Eddy Beckers, Robert B. Koopman, Carolina Lemos Rêgo “Structural change in the Chinese economy and changing trade relations with the world ”[9] analyzed the structural changes in the economy, the factors influencing it and the impact of structural changes on the economy on the example of different countries and for different periods.

Also, scientists Luukkanen, J., Panula-Ontto, J., Vehmas, J., Liyong, L., Kaivo-oja, J., Häyhä, L., and Auffermann, B. “Structural change in the Chinese economy: Impacts on energy use and CO2 emissions in the period 2013–2030” [10] analyzed the structural changes for the Chinese economy and the factors affecting it for the period 2013 and 2030.

Scholars Zheng Jiang and Huimin Shi also explored technological development, migration issues, and structural changes in the economy for China in their article “Sectoral technological progress, migration barriers, and structural change in China” [11].

Scholars such as Aurora A.C. Teixeira and Anabela S.S. Queirós also studied economic growth, human capital, and structural change in their article, “Economic Growth, Human Capital, and Structural Change: A Dynamic Panel Data Analysis” [12]. They also analyzed the impact of human capital and structural changes on economic growth.

Scientists Danny McGowan and Chrysovalantis Vasilakis, in their article “Reap what you sow: Agricultural technology, urbanization and structural change” [13], examined the impact of agricultural technology on the structural changes of the economy for the U.S. economy. They also analyzed the development of agricultural technologies and their impact on the level of urbanization in the regions. As a result of the provision of agriculture with advanced technologies, the share of the agricultural sector in the country's economy will increase, which will lead to structural changes in the economy.

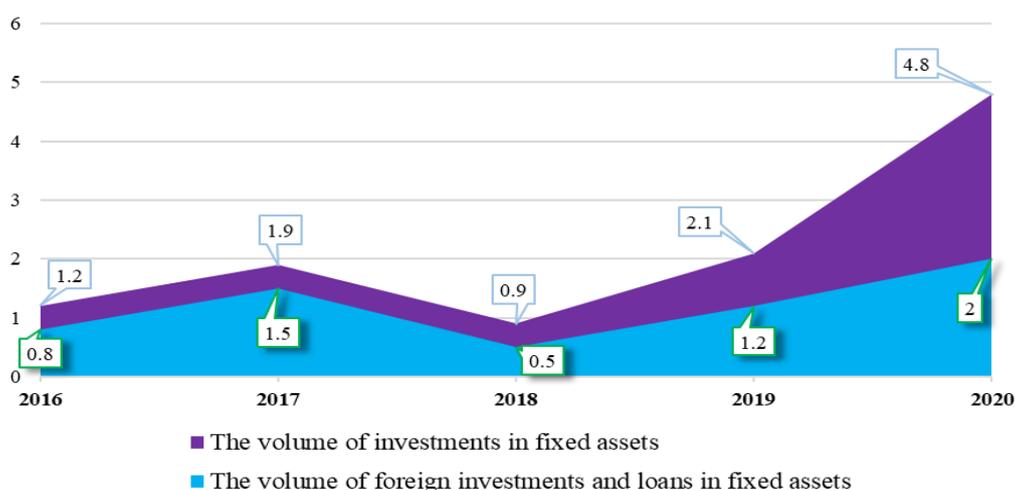
Researchers such as Bingjiang Luan, Junbing Huang, Hong Zou and Cheng Huang studied energy intensity for Chinese industry in their article “Determining the factors driving China's industrial energy intensity: Evidence from technological innovation sources and structural change” [14]. It is based on technological innovation resources and structural changes.

### 3. Data and Methodology

The article mainly assesses the economic situation and structural changes that help to analyze the statistics. As you know, structural changes can only be assessed by working on data. The paper also uses the method of scientific abstraction to study structural changes and the impact of the investment factor on it, without the influence of other factors. In addition, the analysis method was used in the article, as mentioned above. Synthesis was used to collect and summarize the data. The article also provides an econometric analysis of the figures for 2016-2020. That is, the article performs a correlation-regression analysis. In the 2-factor correlation regression analysis, investments in fixed assets as a factor influencing GDP and the gross value added of the ICT sector to GDP are obtained.

It is natural that the digitalization process will lead to structural changes in the economy. Because the advent of digital technology in the economy requires change in almost all sectors of the economy. In many ways, the investment factor also plays a role in this process. The digital economy will continue to grow as a result of ICT investment in the country. On the other hand, an increase or decrease in investment flows to other sectors of the economy leads to structural changes. Uzbekistan is creating a favorable investment climate for investors. As a result, investment flows in all sectors of the economy, especially foreign investment flows, are growing. As a result of reforms aimed at the widespread introduction of the digital economy, the flow of investment in the ICT sector has also increased in recent years (Figure 1).

Figure 1 - Dynamics of Investments in Fixed Assets by Type of Economic Activity “Information and Communication” (Trillion UZS)



[Source: [www.stat.uz](http://www.stat.uz) Author's work based on the official website of the State Statistics Committee of the Republic of Uzbekistan]

In 2016, investments in fixed assets in the field of economic activity “Information and Communication” amounted to 1.2 trillion UZS. The figure is expected to reach 4.8 trillion UZS by 2020. The growth trend can also be seen in the interim period. In 2017, the figure was 1.9 trillion UZS and increased to 2.1 trillion UZS in 2019. Only in 2018 can we see a decline in this figure. At the same time, compared to 2017, almost 1 trillion UZS less investments, i.e. 0.9 trillion UZS in 2018 has been invested in this area.

By type of economic activity “Information and Communication” it can be seen that the majority of investments in fixed assets are foreign investments and loans (Figure 1). In 2016, this type of economic activity amounted to 0.8 trillion UZS. If foreign investments are used, this figure will reach 2 trillion UZS by 2020. In the interim period, in 2017, 1.5 trillion UZS, 0.5 trillion UZS in 2018 and 1.2 trillion UZS in 2019.

In recent years, Uzbekistan has made great strides in the development of information technology, which has helped to expand the digitalization process in many sectors of the economy. The components of the digital economy include e-commerce, e-government, the introduction of “smart” technologies in various sectors of the economy, services, the creation of “Smart City”, “Safe City”, as well as “Internet of Things” widespread use and others.

The level of development of the digital economy is directly related to the level of development of information and communication technologies (ICT) and is usually assessed by various indicators. These indicators include:

- The share of the digital economy in GDP;
- Volume of investments in the ICT industry;
- Internet speed, its coverage of the territory of the country and its convenience for use by the population;
- Level of development of e-commerce;
- Share of public services in the e-government system;
- Provision of ICT specialists and organizations[15].

#### **4. Analysis and Results**

The main indicator of the level of development of the digital economy is the share of the digital economy in GDP. The increase in this share of GDP indicates the expansion of the digital economy in the country. Significant changes have taken place in Uzbekistan due to the intensification of efforts to develop the digital economy. The gross value added of the information and

communication services sector has doubled from 4.4 trillion UZS in 2016 to 8.8 trillion UZS in 2020 soums. In the medium term, this figure has always been on the rise. The figure was 5.7 trillion UZS in 2017, 7.0 trillion UZS in 2018 and 7.4 trillion UZS in 2018. (Table 1).

Table 1 - Dynamics of Growth of the Volume of Services in the Field of “Information and Communication” in Gross Value Added (Trillion UZS)

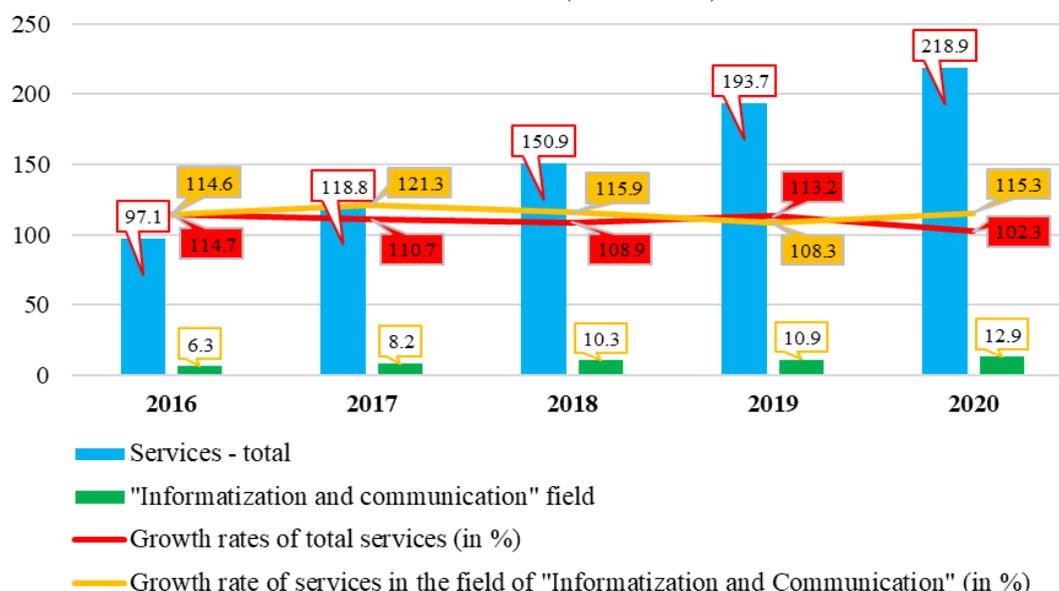
	2016	2017	2018	2019	2020
GDP	242,5	302,5	406,6	510,1	580,2
Gross value added in industry	220,1	267,7	361,1	464,9	535,8
<b>Gross value added in the field of “information and communication”</b>	<b>4,4</b>	<b>5,7</b>	<b>7,0</b>	<b>7,4</b>	<b>8,8</b>

[Source: www.stat.uz Author’s work based on the official website of the State Statistics Committee of the Republic of Uzbekistan]

During this period, the gross value added of the industry increased almost 2.5 times. That’s 220.1 trillion UZS in 2016, 535.8 trillion UZS in 2020. In the interim period, this figure also grew steadily. In 2017, 267.7 trillion UZS, in 2018 361.1 trillion. UZS and 464.9 trillion UZS in 2019.

During this period, the gross domestic product also grew steadily due to the growth of its components. GDP will also increase by almost 2.5 times in 2020 compared to 2016. That’s 242.5 trillion UZS at the beginning of the period. 580.2 trillion UZS at the end of the period.

Figure 2 - Growth Dynamics of the Volume of Services Provided by Type of Economic Activity “Information and Communication” (Trillion UZS).



[Source: www.stat.uz Author’s work based on the official website of the State Statistics Committee of the Republic of Uzbekistan]

Services in the field of information and communication economic activity also showed a growth trend during the period under review. In other words, the volume of services increased from 97.1 trillion UZS in 2016 to 218.9 trillion UZS in 2020 (Figure 2). Total services grew by at least 8% during the period under review. At the end of the period alone, the figure fell to 102.3%. At the beginning of the period, in 2016, the growth rate was 114.7%.

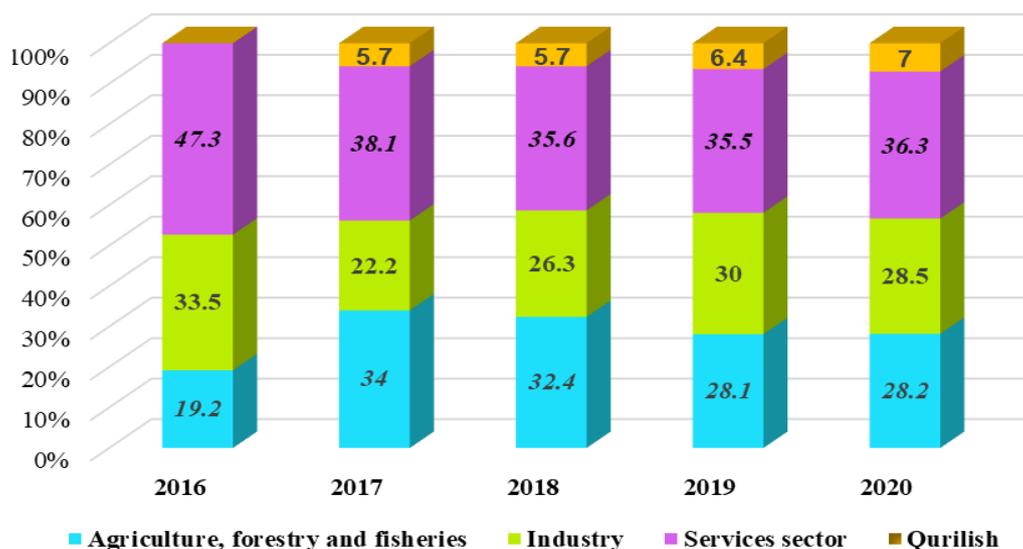
The volume of services created in the field of “Informatization and Communication” in 2016 amounted to 6.3 trillion UZS, which will double to 12.9 trillion UZS in 2020. In the interim period, from 2017 to 2019, respectively, 8.2 trillion. UZS, 10.3 trillion UZS, 10.9 trillion UZS.

This indicator recorded regular growth rates and achieved at least 8.5 growth rates during the analyzed period. In 2016, the growth rate was 114.6%, while in 2020 the figure rose to 115.3%.

During the period under review, the share of sectors in the economy also changed as a result of reforms aimed at deepening structural changes in the economy. The share of agriculture, fisheries and forestry in GDP in 2016 was 19.2%, in 2017 this figure rose to 34% and at the end of the period there was a downward trend to 28.2%.

During this period, the share of industry in 2016 was 33.5%. At the end of the period under review, the figure was 28.5%. In the period between 2017 and 2019, the figure had a tendency to increase from 22.2% to 30%. At the beginning of the period, in 2016, the construction figure was calculated in conjunction with the industry. Due to this, the gross value added of the industry to GDP in 2016 is high.

Figure 3 - Gross Domestic Product by Structures of GDP (In Percent)



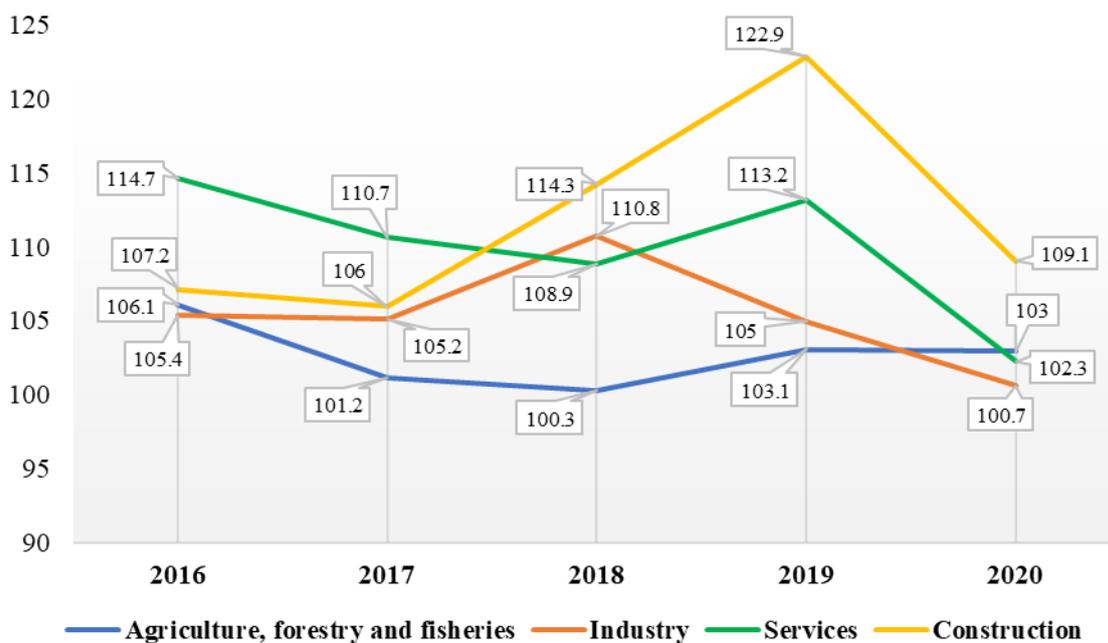
[Source: www.stat.uz Author’s work based on the official website of the State Statistics Committee of the Republic of Uzbekistan]

The service sector is the sector with the largest share of GDP in all parts of the analyzed period. During this period, the figure ranged from 35% to 48%. That is, in 2016, the figure was 47.3%, in 2017 it was 38.1%, in 2018 it was 35.6%, in 2019 it was 35.5% and in 2020 it was 36.3%. The share of the gross value added of the services sector in GDP is higher than in other sectors. This is one of the main factors influencing high economic growth.

An analysis of the construction work shows that there is a growing trend during this period. That is, during this period, the gross value added of construction to GDP increased from 5.7% in 2017 to 7% in 2020. In 2018, the figure was the same as in 2017 and remained unchanged. In 2019, it will increase to 6.4%

An analysis of the growth rates of the components of GDP shows that relatively low economic growth has been achieved in the agricultural, forestry and fisheries sectors compared to other components. This growth rate ranged from 0.3% to 7% during the period under review. In 2016, the growth rate in this sector was 106.1%, while in 2018 it dropped to 100.3%. In 2020, it will increase to 103%.

Figure 4 - Growth Rate of Structures of GDP (In Percent)



[Source: www.stat.uz Author's work based on the official website of the State Statistics Committee of the Republic of Uzbekistan]

The industry reported high growth rates during the period under review. In 2016, the industrial growth rate was 105.4%, while in 2018 it rose to 110.8%. In the following period, this indicator showed a relative downward trend. That is 100.7% in 2020.

The services sector grew faster than other components of GDP. This figure achieved a growth of at least 108% between 2016 and 2019. That is, in 2016, the figure was 114.7%, and in 2019 it was 113.2%. In 2020, as a result of economic inactivity caused by the pandemic, the sector also experienced relatively low growth. That is 102.3% by 2020.

The construction sector is the fastest growing sector in the world. That is, it achieved a growth rate of at least 106% during this period. The highest growth was observed in 2019, reaching 122.9%.

The utilization of fixed capital investments also increased during the period under review. If in 2016, 51.2 trillion UZS were invested, 202 trillion UZS were invested in fixed assets (Table 2) by 2020. In the interim period, the volume of investments has been growing.

Table 2 - The Volume and Growth Dynamics of Investments in Fixed Assets

	2016	2017	2018	2019	2020
Volume of investments in fixed assets (trillion UZS)	51,2	72,2	124,2	195,9	202,0
Growth rate of fixed capital investment (in percent)	104.1	119.4	129.9	138.1	91.8

[Source: www.stat.uz Author's work based on the official website of the State Statistics Committee of the Republic of Uzbekistan]

An analysis of the growth rate of investments shows that during this period there was a sharp increase in this indicator. The growth rate was 104.1% in 2016, but by 2019, the figure had risen to 138.1%. The only reason for the pandemic is the decline in 2020.

As a factor influencing the volume of investments in fixed assets and the gross value added of the ICT sector to GDP, we perform a correlation-regression analysis, taking GDP as a result. Based on the correlation analysis, the following table results can be obtained:

	<i>GDP</i>	<i>Fixed capital investments</i>	<i>Gross value added of ICT</i>
GDP	1		
Fixed capital investments	0.98769885	1	
Gross value added of ICT	0.97624179	0.9361527	1

Correlation analysis suggests that there is a strong correlation between GDP and fixed capital investment. Because the correlation coefficient between GDP and investment in these indicators is 0.987 and is between  $\pm 0.7$  and  $\pm 1$ , it is clear that the correlation is strong.

A similar situation can be observed between GDP and gross value added in the field of ICT. That is, there is a strong correlation between these indicators. This is because the correlation coefficient between these values is 0.976, and the gap is strong because it falls between  $\pm 0.7$  and  $\pm 1$ .

There is also a strong correlation between fixed capital investment and the gross value added of ICT. That is, the correlation coefficient for these two indicators is 0.936, which is also between  $\pm 0.7$  and  $\pm 1$ , so the correlation is strong.

When a regression analysis is performed on these parameters, the regression equation looks like this:

$$Y=1,21X_1+34,86X_2+19,93$$

Here, factor  $X_1$  is the volume of investment in fixed assets, and factor  $X_2$  is the gross value added in the field of ICT.

From this equation, it can be concluded that the result score, which is not affected by any factors, is 19.93. That is, without the influence of these factors, the GDP will be 19.93 trillion UZS. The first factor, a change in investment by 1 unit, leads to a change in GDP by 1.21 units. Or an increase in investment by 1 trillion UZS to increase GDP by 1.21 trillion UZS. The second factor, the change in the gross value added in the field of ICT by 1 unit, leads to a change in GDP by 34.86 units. In other words, if the gross value added in the ICT sector increases by 1 trillion soums, it will increase GDP by 34.86 trillion UZS.

## 5. Conclusion

Structural changes in the economy have always been important. In general, structural changes can be thought of as changes in the structure of the economy or changes in the share of the sectors that make up the economy. Positive structural changes usually lead to economic growth or high economic growth. In Uzbekistan, in the early years of independence, the agricultural sector contributed more to the formation of the economy, but later the agricultural sector passed the lead to industry, and in certain years, industry has made a significant contribution to GDP. In the years that followed and in the years to come, the services sector continued to play a major role in shaping the economy. There are several factors that contribute to structural changes. Especially today, the development of the digital economy has accelerated this process and led to the addition of new

sectors to the economy. The increase in investment flows in the ICT sector in the country will lead to the development of this sector. This is a key factor in shaping the digital economy in the country.

The analysis shows that in 2016-2020, the Uzbekistan's economy is undergoing structural changes. The economy is growing as a result of the addition of new sectors and the development of the digital economy. The contribution of each sector in GDP has changed over this period, with high growth rates in each sector. In particular, the growing share of the services sector indicates that the economy is developing, and this is seen as a positive development in the world experience. In particular, the addition of digital services to the sector has contributed to this increase.

During this period, the volume of services in the field of "Information and Communication" has increased, which has led to the rapid development of the digital economy in the country. In the context of digitalization, structural changes take a short time. Moreover, in this case, it will be easier for the economy to adapt to the new environment. This encourages structural change in the economy and accelerates the process.

According to econometric analysis, there is a strong correlation between GDP, fixed capital investment and gross value added in the ICT sector. An increase in these indicators will have a positive impact on GDP growth. In addition, the digital economy is developing in the country as a result of increasing investment in the ICT sector.

Increasing the volume of investments in the ICT sector can, firstly, contribute to the further development of the sector, and secondly, to the development of the digital economy in the country. The development of the digital economy will create new services and new sectors in the country. This process has a positive effect on structural change.

In general, structural changes and the development of the digital economy can be achieved by increasing investment flows into the country's economy. This requires the formation of a favorable investment climate in the country. On the basis of increasing the investment attractiveness of the country, it is possible to increase the inflow of foreign investment. With the inflow of foreign investment, new equipment and technologies, highly qualified personnel are coming. As a result, the country's manufacturing and services sectors are developing rapidly. In particular, it affects the formation of GDP in the country and leads to structural changes. In addition, in the context of digitalization, the implementation of such reforms will accelerate the process and ultimately ensure high economic growth. The implementation of these processes will ensure macroeconomic stability in the country.

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