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# Problems of application of digital technologies in the territories of Azerbaijan liberated from the Armenian occupation

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## ABSTRACT

The article substantiates the importance of the application of digital technologies in the economic processes of Karabakh. It identifies the development trends of establishing a new economy in the territories liberated from 30 years of Armenian occupation. The problems of the application of the 4.0 Industrial Revolution in the development of the digital economy in Karabakh are studied. The ways of greening the ecological environment and increasing economic inclusion in the region are identified. The features of forming innovative infrastructures, digital technologies and data economy are analyzed. Digital transformation is shown to be one of the country's top priorities. The problems of digital transformation in the development of Karabakh are studied and their solution tendencies are identified, the importance of the development of promising digital projects is indicated. A conceptual model of the architectural and technological structure of the E-Karabakh complex plan is proposed for the revival of Karabakh. The features of transition from the traditional Karabakh regional economy to the new Karabakh smart digital economy are studied. "Green" development issues, clean ecological environment and green development tendencies in Karabakh are identified. Improvement of ICT-based infrastructure, the application of high digital technologies in Karabakh can reveal additional potential opportunities to increase the efficiency of the digital economy in the new economic management and to develop the Karabakh economic region.

## 1. Introduction

Modernization of the economy on the basis of technological innovations, development of high-tech spheres such as artificial intelligence, robotics, information and communication, space, etc. are considered as the main trends for the revival and faster development of relevant real economic sectors in the modern times. The production fields of science-intensive, competitive high-tech products have become the main sector of the world economy in line with the challenges of the recently formed Industry 4.0 Revolution Platform [1].

The National Priorities for Socio-Economic Development of Azerbaijani society and economy [2] state that reintegration of our territories liberated after 30 years of Armenian occupation into the general traditional and new economy, creation of important new international and regional transportation-logistics corridors and greater benefit from these opportunities will significantly incite the

development of Azerbaijan. The National Priorities of the country and the region are also important in line with "performance of world transformation duties in sustainable development field by 2030" of the United Nations (UN) [2]. Thus, one of the Sustainable Development Objectives [3] of the UN - development problems of industry, innovations and infrastructure have become of the main directions in the development of world economy at World Economy Forum, along with requirements of Industry 4.0 Revolution Platform. New state programs and development strategies are being developed to ensure the sustainability and effectiveness of recent economic reforms in Azerbaijan. Newly adopted National Priorities [2] on social-economic development state that reintegration of new territories liberated from Armenian occupation, creation of new transportation-logistics corridors and their new capabilities will greatly incite the development of Azerbaijan.

Digital transformation of economy is currently one of the key issues currently faced by the country [4, 5]. Development of Internet, which is the foundation of ICT infrastructure, and implementation of promising digital projects such as Government Cloud (G-cloud), Big Data, Smart City, Smart Village etc. is planned. Consistent reforms are carried out in order to turn Azerbaijan into a digital and technological center of the region [4].

Sectors of novel technological innovation economy based on ICT are being more rapidly developed in Azerbaijan. New opportunities are emerging in the development of areas such as mobile management mechanisms, mobile cloud technologies, mobile government technologies, mobile vehicles, etc. For this purpose, establishment of modern complexes for development of new technologies and innovative structures of different purposes with high export potential must be considered in Karabakh economic region in order to achieve a faster development of traditional economic sectors. In Karabakh economic region, global challenges and international trends in economic development must be taken into account to the maximum for development of sectors of national economy such as industry, agriculture, construction, etc. with the application of innovative, digital technologies. During establishment of innovative development infrastructure in these regions, attention must be paid to the creation of clusters, high-tech parks and centers stimulating the development of start-ups, business incubators, innovation and entrepreneurship centers, industrial and agrarian innovation enterprises. High Technology park and science-based industry and agrarian techno-parks are the main driving force for transition from existing traditional Karabakh economy to the new smart-type Karabakh digital technology economy. Development of Electronic-Karabakh complex state program in Karabakh economic region and implementation of corresponding work within the framework of this concept and program have become significant issues for the Republic. Among the main objectives and tasks of the society is the establishment of "Smart" cities and villages, intellectual systems and infrastructures in Karabakh economic region, and identification of perspective directions for the digital transformation and solution of its problems for the restoration and development of the Karabakh economy.

## **2. Development of traditional sectors and new spheres in the economy of Karabakh region**

Restoration of traditional economic spheres in the territories of Azerbaijan liberated from the Armenian occupation is of great significance. Development of construction, industry, agriculture and military industry during the following 10-15 years in Karabakh region is one of the most important and priority directions of the modern age. Increasing their share in the country's GDP will provide significant benefits for the future development of the Azerbaijani economy. Modern economy thrives on knowledge, science, high technology and innovations. Based on technological innovation, transition from traditional economy to information-based economy and modernization of economy takes place [6]. New Technologies positively affect the development of both already developed and newly developing economic spheres. Wide application of digital technologies in development of the traditional economy will result in the growth of economic development. As the new economic sector develops and the new jobs are created, the population's welfare will also improve.

Accordingly, GDP per capita in general is estimated to increase further. This will lead to the development of both economy of the Republic and the non-oil sector in parallel with the traditional economic sectors in Karabakh and its neighboring regions, the growth of the economy of Azerbaijan on a global scale and the level of competitive production in the global market. Along with the modernization of traditional sectors of the economy, new ICT-based innovation economy sectors are being developed in Azerbaijan. The development of the latest technological innovation sectors of the economy, such as mobile systems and technologies, space, Big Data, cloud, Internet of Things, cyber-physical systems, artificial intelligence technologies, etc., and the application of ICT in its formation are among important issues for now [6, 7].

Considering aforementioned, in our opinion, the conceptual model of the architectural and technological structure of the Electronic Karabakh complex action program can be proposed as depicted in Figure 1.

Proposing a conceptual model in such a structure is explained by the fact that the country is experiencing a transition to a new model of regional governance. 13 regional economic zones have

already been established and namely, Karabakh economic region is one of the most significant among them. The parts of the region liberated from the Armenian occupation are completely destroyed. In these territories the economy needs to be completely rebuilt. In reality, the situation is even more problematic. Thus, in order to rebuild the economy, these areas must be cleared from mines and made safe, and then the remaining debris must be cleared to re-establish the appropriate infrastructure. Therefore, there is a need to revive even traditional economic sectors on the basis of modern innovative achievements and technologies. Effective relations with international and local governments must be established to build a new economy through the application of technological innovations. Moreover, innovative production/service structures, information-knowledge resources/systems/structures should be formed in accordance with the requirements of the Industry 4.0 Revolution in the trends stated in the conceptual model.

### **3. Applications of Industry 4.0 Revolution in development of the economy of Karabakh**

There are certain features of the implementation of digital transformation in the Karabakh region. Relevant infrastructure in line with digital transformations in Azerbaijan and its regions must first be formed in accordance with the global trends.

Application and significance of some technological innovations within the Industry 4.0 Revolution must be greater in the Karabakh region. [1]. Financial development, as well as development of blockchain technologies, emergence of new network cryptocurrencies will cause many social-economic and social-financial changes in international monetary-financial relations. 3D printing will create new manufacturing, marketing, advertising technologies. As a result of the industrial revolution, there will be a serious need for new management mechanisms in the fields of energy generation and storage, as well as environmental relations due to the emergence of new alternative energy sources.

Application of 3-D printing technology must be enhanced in different spheres, Industry 4.0

Revolution-based [1, 8] new interfaces, mobile Internet, Internet of Things, digital person, pocket super-computer, smart city, big data technologies, self-driving (driverless) cars, artificial intelligence, robotics technology, cryptocurrency technologies, manufacturing, education, medical field and mass demand products spheres. Research shows that the innovations brought by the Industry 4.0 Revolution create new revolutions in modern times, creating promising opportunities for its transition. Thus, the interaction of the structural elements of the existing innovative technologies in the Industry 4.0 Revolution, their operation and further improvement of the relationship between these elements in the near future create ample opportunities for the sustainable development of new technologies. One of the most important new technologies – Big Data has had a major commodity function in modern times for a long period of time. The newest methods are used to collect, store, process, protect, use and transmit such large, mixed and unregulated structured data.

Currently, world countries are investing more in technologies such as 5G, Big Data base, artificial intellect and quantum calculation [9]. 5G is projected to generate 13 trillion USD in value and create 22 million new jobs by 2035, and the global artificial intelligence market is estimated to reach 15 trillion USD by 2030. By 2025, the revenues from global Internet of Things (IoT) technology are estimated to increase more than triple hitting 1.1 trillion USD. By 2035, up to 50% of jobs are believed to be automated.

In accordance with the international development trends, the formation of the concept of digital transformation in Azerbaijan involves important issues such as protection of confidentiality of information, regulation of content and digital commerce, ensuring cyber security. Today, most of the world's Great Powers are building their own data economies. The rapid development of digital transformation in the world also creates opportunities for the development of quantum transformation. Consequently, the development of ICT is estimated to bring 15.7 trillion USD to the world economy by 2030. These forecasts show the importance of digital transformation for the economic development of the country, including Karabakh.

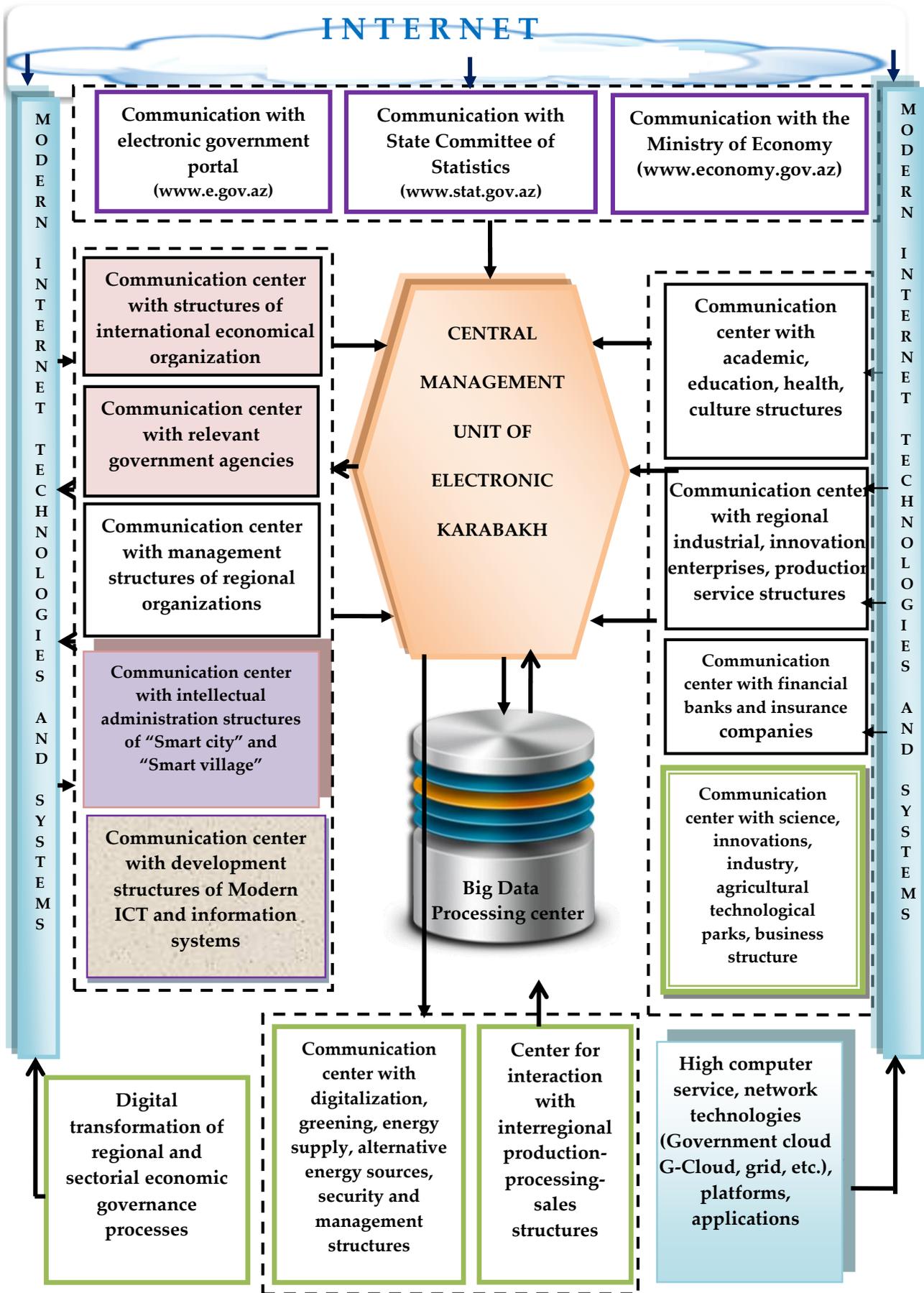


Figure 1. Conceptual model of the architectural and technological structure of the Electronic Karabakh complex action program

#### 4. ICT-based green development in the economy of Karabakh

Given the scale of the global climate change in the regions, an important position should be allocated to the use of ICT-based environmentally friendly technologies. Clean energy sources must be used, waste must be recycled and contaminated areas must be rehabilitated. Based on ICT, along with future economic development of the country, rapid restoration and growth of greenery in the environment, efficient use of water resources and energy sources must be provided [2, 10, 11]. Effective realization of the objectives such as high-quality ecological environment, green energy space must be achieved based on the establishment of relevant innovation and information structure. At present, relevant work is being done to turn Karabakh into a green energy zone. The development of a green zone or green space concept in the region, which will cover the use of renewable energy sources, environment-friendly technologies and other issues, began shortly after the victory in the Patriotic War.

Important tasks have been set to establish a “green energy” zone in the liberated territories. This issue is represented in “Azerbaijan 2030: National Priorities for Socio-Economic Development.” Moreover, an order “On the measures to establish a “green energy” zone in the liberated territories of the Republic of Azerbaijan” was signed [12].

In the strategic period, the use of alternative and renewable energy sources supported by ICT systems in advanced countries will particularly increase. Energy must be used efficiently and new alternative energy sources must be given preference. In order to meet the needs of future generations, the use of ICT-based environmentally efficient green technologies must be expanded. The share of alternative energy sources in primary consumption in all sectors of the economy must be increased and its impact on climate change must be reduced. The use of environment-friendly vehicles are believed to have a positive impact on ambient air quality [2]. New sustainable energy sources must be preferred in the country.

#### 5. Characteristics of digitalization of the economy and application of digital technologies in Karabakh

The President of the country stated in his speeches that the settlements in the liberated territories will be restored on the basis of the concepts of “Smart City” and “Smart Village”, which are the main trends of the

Industry 4.0 Revolution. Signing of the decree on development of the concept of “Smart City” and “Smart Village” [13] to turn the country into a regional center for the Industry 4.0 Revolution is a clear example of this. Improving the quality and efficiency of services provided in urban and rural areas, the application of ICT in their provision, as well as ensuring the effective management of available resources for these services are among the main priorities for sustainable development in urban and rural areas.

The use of modern telecommunications, sensors, big data and other digital and artificial intelligence technologies, as well as science and knowledge makes socio-economic and social relations more efficient, creating new income opportunities in the value chain of the economy. Improving the quality of decision-making and management based on the generation, collection, storage, processing and analytical analysis of digital data through the use of modern technologies creates a wide range of opportunities for rendering effective services [14, 15]. These opportunities lay the foundation for the transition of services provided in cities and villages to functional, large-scale “Smart City” and “Smart Village” services in the next stage of development. The idea of “smart village” is a project aimed at preventing urbanization by facilitating life in rural areas around the world and making villages more habitable, and consists of through-the-network performance of all operations directed at the simplification of all services rendered in the villages. Another goal is to create real conditions for the development of small and medium enterprises in the village, as well as the opportunity for people to earn money in the village [13]. Simplification of public services and their provision over the Internet would become one of the factors involving the villagers to their territory, and due to this idea, the residents would act as small entrepreneurs. On this basis, unification of smart infrastructure and services, smart economy and business, smart public administration is provided in the “smart village”.

Application of modern technologies in agriculture in Karabakh and other regions is one of the key topical issues of the country. It is possible to create opportunities to analyze the characteristics and agro-chemical composition of agricultural areas through unmanned aerial vehicle technology used in agriculture. It is also a modern technology aimed at increasing the efficiency of arable land, reducing prime costs, protecting the environment and increasing productivity. The main goal here is to demonstrate the application opportunities of new technologies in cotton-growing.

## 6. Technologies of increasing economic inclusiveness in Karabakh region

A socially oriented market economy is being developed in order to further increase the welfare of the population in the regions of the country [2]. Economic growth based on inclusive initiatives must be accelerated to sustainably increase the welfare of the population. Ensuring the return of the refugees to the liberated territories is the basis of the country's new development highway. For sustainable and rapid development, the successful combination of society, business and government triad must be strengthened. The role of the government in the economy must be effectively managed through market-oriented reforms. Trade regimes must be liberalized in order to increase the access of domestic products into the foreign markets. New basic principles of economic growth must be established. Effective macro-economic policy must be determined. The medium- and long-term "driving forces" of economic development must be fortified. Human resources must be developed, improved and modernized. Scale and volume of digital economy must be enhanced.

To increase the regional economic inclusiveness, the revolutionary measures are taken to strengthen the social protection of the population [16, 17]. In order to increase the inclusiveness of society in the regions, inclusive strategic concepts, projects and programs that cover relevant areas and implement inclusive policies must be implemented. ICT platforms such as e-science, e-education, e-government, e-parliament, e-business, e-banking, e-commerce, etc. must be formed based on the wishes of members of society. They must be integrated with global systems such as necessary components of the information and knowledge society. The communication and communicative environment expanding the effectiveness of ICT, creates great opportunities for increasing the inclusiveness level. Cell phones, computers, websites, etc. act as a new type of work tool in the form of a new productive force, regardless of time and space. This problem can be positively solved only in the information and knowledge society based on ICT and innovative technologies. Globally applied Internet of Things (IoT), cloud computing, soft computing, Big Data technologies, Industry 4.0 Revolution components will create additional opportunities for joint activities of citizens and increase the level of inclusiveness in the society.

## 7. About prospective economy of the regions of Karabakh

Large-scale restoration works are being performed to ensure the rapid integration of the territories of the Karabakh economic region of the Republic of Azerbaijan into the national economy. Implementation of renovation works in these liberated territories and formation of a competitive economy to ensure the settlement of the population is of particular importance.

An effective production, trade and service infrastructure must be established for ramified development of the regional economy in line with national priorities. Investments involving the application of innovative technologies must be attracted. Favorable conditions must be created to improve the entrepreneurship environment.

Favorable geographical position of the liberated Aghdam region, opportunities for socio-economic development, future growth of cargo flows make it necessary to create an industrial park with modern infrastructure in the region [18]. Aghdam Industrial Park is an area with the necessary infrastructure and management entities for the development of entrepreneurship activities used for the manufacturing and sale of competitive products in the field of industry, as well as the provision of services through the application of modern technologies. The industrial park to be established in Aghdam is estimated to produce construction materials, agricultural processing products, as well as wine and fertilizers. There will also be a special cold storage and service area [19]. The industrial park will allow entrepreneurs to be involved in the activities in many areas of processing. It is planned to have wide roads in Aghdam and to use different types of transport. This is important in terms of increasing citizens' access to transport services and use of more comfortable, convenient transportation means. In general, the future requirements of the transport infrastructure to be formed in accordance with the Master Plan are taken into account.

During the Soviet era, Azerbaijan was famous for its "Aghdam" wine. Although the production of this wine was resumed, and it does not have its previous position. Obviously, "Aghdam" wine, being produced in the USSR since 1948, was one of the best-selling wines.

Over 92% of the lands of Aghdam region are fertile. This creates great opportunities for the development of the agricultural sector. The Master Plan states that after the restoration, Aghdam will

become an industrial center of the region. It is planned to invest millions of manats in the new industrial park to be established in Aghdam. This will create hundreds of jobs and involve many entrepreneurs in the process. Along with local investment, foreign investment is expected to be drawn in to Aghdam. It contemplates the production of not only agricultural products, but also industrial products, some of which are projected to be used to meet domestic demand, and some to be exported. Aghdam also have a tourism potential. The natural and historical monuments of the region have an advantage in terms of attracting tourists. There are many opportunities for summer tourism in Aghdam in particular. Aghdam will have the opportunity to export some of the manufactured products via the North-South transport corridor. This will especially help Aghdam's exports in the non-oil sector. Restoration, reconstruction and economic formation in other liberated regions will further accelerate the growth rate of the economy of Azerbaijan. Based on preliminary forecasts, Karabakh economic region is estimated to create an approximately 10% additional value in the agricultural field, which will accelerate the growth rate of the industry and economy of Azerbaijan.

## 8. Conclusion

Many large-scale projects on the widespread use of ICT in manufacturing-service and management processes have been implemented in the modern period. Nevertheless, the digital transformation of the regional economy remains as one of the priorities of the country in recent years. However, the development of ICT infrastructure, the implementation of promising digital projects such as "Smart City", "Smart Village" and others have launched in the regions. As a result of these, regions can become the digital centers. Necessary infrastructure and services can be formed for "Smart city" and "Smart villages" projects. Efficiency of the quality of services rendered with the application of modern ICT in many cities and villages can be increased in regional context.

In this regard, it can be concluded that the transition from a traditional economy to a technology and innovation-based economy is of particular importance in post-conflict areas. Thus, new digital and artificial intelligence technologies create new income opportunities in the overall value chain of the economy. The use of these technologies creates a wide range of opportunities for the processing of digital data and improving the quality of management. It can

be presumed that innovation structures are becoming the driving force for the transition from a traditional economy to an innovative one [20]. Their creation is important for development of innovation-based economy in the country. Certain measures must be taken to establish perspective directions of digital transformation in the recovery and development of the economy in the Karabakh region and to identify the aspects of its impact on socio-economic processes. Recommendations and challenges of international organizations, the requirements of the Industry 4.0 Revolution must be taken into account and relevant activities must be performed during modernization of development of the country's economy in the territories liberated from occupation.

Development of traditional sectors and new sectors is particularly important in both economic and socio-political contexts in the Karabakh economy, which is in line with the country's key national development priorities. Application of modern technologies is important for exploring the development trends of economy-building based on digital technologies, and continuously increases the level of welfare and increase the level of inclusiveness in Karabakh. Formation of innovation infrastructure and application of digital technologies in Karabakh economic region is among topical issues of the country. Further improvement of ICT infrastructure in the territories liberated from Armenian occupation, wide application of digital technologies will create additional opportunities for increasing the efficiency of the digital economy and for state's course on the development of Karabakh in terms of conditions of new economic reforms. This will not only play a catalytic role in rapid development of other regions of the country and manufacturing-service sectors, but will also have a significant positive impact on settlement and security issues in the border areas.

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