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Section 1. Innovation management

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EXPLORING THE USE OF ARTIFICIAL INTELLIGENCE TO SOLVE TRAFFIC CONGESTION

Abstract. This paper reviews the applications of artificial intelligence (AI) innovations in the field of worldwide transportation management to explore the feasibility of using artificial intelligence to solve traffic congestion. Regional experimental applications of AI powered systems, applied to transportation planning, navigation, law enforcement, smart traffic lights, and driverless cars, provide promising results that AI can solve traffic congestion in the near future.

Keywords: Artificial Intelligence, Traffic Congestion, Smart Traffic Light, Induced Demand, Autonomous Car, AI Robotic Polices.

I. Introduction

As technology advanced over time, automobiles replaced the bike and became the primary transportation vehicle in the world, including China. For example, in 2018 alone, the number of cars sold reached around 86 million in 54 markets worldwide (Bekker [2]). The convenience of driving cars, however, brings with it the problem of traffic congestion. Based on a report by INRIX, in 2018, every American driver spent an average of 97 hours per year in traffic jams (Bradford [4]). According to INRIX, economically, traffic congestion cost the US $87 billion in lost productivity, an average of $1348 per driver, in 2018 (Le Beau [14]), and environmentally, traffic congestion wastes 19 gallons of fuel per commuter, which seriously depletes our valuable non-renewable resources ("Fact No. 897" [11]). As early as 2014, Peking University's National Development Research Institute assessed that traffic congestion costs Beijing $11.3 billion a year ("Traffic Jams Cost Beijing $11.3b a Year" [20]). If we can solve the problem of congestion, people could spend their time in other meaningful pursuits rather than idly waiting in traffic, economic losses would be dramatically reduced, and natural resources could be saved for better use. How can we solve this problematic situation? One approach is that the problem caused by advanced technology can only be solved by more advanced technology in the form of artificial intelligence.

The exploration of artificial intelligence began in the mid-19th century. The word "Artificial intelligence" was coined by John McCarthy in a conference he organized. *The Dartmouth Summer Research Project on Artificial Intelligence* in 1956. Allen Newell, Cliff Shaw, and Herbert A. Simon presented the Logic Theorist, which was designed to mimic the problem-solving skills of a human and considered by many people as the first AI program, in the conference (Anyoha [1]). Typically, Artificial intelligence is classified into three groups: Artificial

Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Super Intelligence. (ASI) ANI is professional in one field, but only in the specific field that it is designed for. Every kind of brainwork performed by a human can be performed perfectly by AGI; they hold the ability of reasoning, problem-solving, are self-conscious, self-aware, and can independently solve problems and find solutions. According to Nick Bostrom, a philosopher at the University of Oxford and professor of artificial superintelligence, Artificial Super Intelligence "is much smarter than the best human brain in practically every field, including scientific creativity, general wisdom, and social skills" (Bostrom [3, P. 11]). Scientists have been innovating artificial intelligence because of its advantages and benefits. Artificial intelligence beats humans in speed, has unlimited storage space, and long term durability, not to mention its ability to upgrade, save, and edit (Urban [18]). In fact, a microprocessor's speed is 10 million times faster than human neurons. (2GHz V.S. 200Hz) Currently, our society is in the stage of extensive use of Artificial Narrow Intelligence as it increasingly becomes an indispensable part of our life. Many websites and navigation maps like Google, Baidu, Google Maps, Amap, and Baidu Maps have AIs in their system, while sports, finance, manufacturing, and even medical fields all use products with AI technologies. The question then is, can we employ artificial intelligence into the field of traffic control and use AI to help solve the problem of traffic congestion? This paper reviews the current application of AI in traffic control and explores the feasibility of wider implementation.

II. Previous solutions to traffic congestions

In the past, governments usually relied on widening roads or expanding transportation systems to solve traffic congestion. However, as the induced traffic theory shows, increased roadway traffic capacity will also increase the number of cars on the road as the new road now allows more cars to use it simultaneously. Also called latent demand, this theory is consistent with the economic concept of supply and demand. As the supply (expansion of current roadway) increases, the demand for using car as a means of primary transportation also increases. This theory was recognized as early as 1974 in New York by Robert Caro. His book, *The Power Broker*, he illustrated that roads actually aggravate congestion without a properly balanced transportation system, using evidence from the highway building programs of Robert Moses (Caro [5]). The reasoning behind induced demand is also explained by J. J. Leeming in his book *Road Accident: Prevent or Punish?,* "Motorways and bypasses generate traffic, that is, produce extra traffic, partly by inducing people to travel who would not otherwise have done so by making the new route more convenient than the old, partly by people who go out of their direct route to enjoy the greater convenience of the new road, and partly by people who use the towns bypassed because they are more convenient for shopping and visits when through traffic has been removed" (Lemming [15]).

The case of the Katy Freeway in Texas is a good modern example, as it is the widest freeway in the world. The Katy Freeway underwent an expansion project at a cost of $2.8 billion between 2008 and 2011 intended to relieve traffic. However, after expansion, it was found that the travel times increased by 30 percent in the morning and 55 percent in the evening (Schneider [16]). This result was also consistent with research results from economist Matthew Turner of the University of Toronto and Gilles Duranton of the University of Pennsylvania. They compared the number of new roads and highways with the amount of traffic between 1980 and 2000 and discovered that when the road capacity increased a certain percent, the vehicle-kilometer traveled also correspondingly increased the almost identical percent. Turner and Duranton concluded that, "increased provision of roads or public transit is unlikely to relieve congestion" (Turner and Duranton [10]).

One more approach is to charge tolls to ease traffic during peak hours. For example, in Manhattan,

New York, drivers were required to pay a surcharge between 6 a.m. and 8 p.m. when they entered Manhattan south of 60th street and north of Battery Park or in the central business district. However, equity problem arose with this policy as most people driving into Manhattan were middle class and not the wealthy residents of Manhattan. In Long Island and Brooklyn, many residents were against this policy because they preferred driving because the subway stations were too far. This congestion relief pricing was also explored in China as early as 2016. China Youth Daily took a survey of more than 2000 participants, asking their opinion on a congestion relief fee. 68% of the participants believed that a congestion fee would only "cure the symptom, but not the disease" (J. Chen [7]).

Another approach to control the volume of traffic was implemented in Beijing, China, where cars with odd numbered license plates drive on odd days and even numbers on even days. This policy effectively reduces the amount of cars driven on the road in the short run, but will lose its effectiveness over time as those with enough financial resources could simply buy another car. Therefore this law could actually increase the amount of cars in the city. It is necessary to explore the root causes of traffic congestion to design more effective solutions to traffic congestion.

III. Causes of traffic congestion

I classified the causes of traffic congestion into three categories: road-related, human-related, and technology-related. Road-related congestion includes both the number of vehicles exceeding the capacity of the road and the poor design of the roads themselves. This type of traffic congestion usually happens in the period between 6a.m.– 9a.m., and 5p.m.– 7p.m., when the majority of commuters drive to work. This type of congestion mostly happens on vital communication lines, commercial central districts, roads with lots of traffic lights or works, and scenic spots. These places are where most drivers are traveling, and as numbers of cars converge together traffic congestion inevitably occurs. Road-related congestion is primarily caused by people choosing vehicles over public transit. People prefer driving over public transit not only because of its privacy and comfort, but also for its convenience and flexible timing (Downs [9]). Another cause of road-related traffic jams is inefficient road designs. For example, in Beijing, the roads are designed as a radial from a central point, which was designed to be convenient for transportation between the suburbs and city center. However, during certain hours, all the vehicles from the surrounding suburbs are moving towards the city center, and the main roads in the city are filled with the inflow of traffic (C. Chen [6]).

Human-related traffic congestion includes all congestion resulting from human activities, whether consciously or unconsciously. It includes traffic congestions that could be avoided, such as accidents, which are unintentional, and traffic violations, which are mostly intentional. It's common to see aggregated traffic in both directions if an accident happens on one side of the highway. Similarly, when cars or pedestrians are stopped by the police to check their violations, the traffic is slowed down which leads to congestions. If a car is parked in a space that isn't designed for parking, all the cars passing will experience driving difficulties and slowed traffic.

Technology-related traffic congestion refers to any traffic jams that can be improved by more advanced technology, including utilizing the unprocessed traffic information to improve the inflexibility of traffic lights. Compared to road-related congestion, Artificial Intelligence can solve the problem of human-related and technology-related congestion in a significantly shorter period. In fact, AI is solving these two types of traffic congestion right now.

IV. Using ai to solve traffic congestions

While it is obvious that the use of AI can directly help to reduce technology-related congestion, it can also help to alleviate congestion problems arising from the other two causes. Even though AI cannot help to physically change the design of existing roads,

it can be helpful in terms of guiding traffic volume over the road system, thus reducing congestion of the road-related and human-related types.

The foremost way AI can help road-related congestion is to promote public transportation and therefore reduce the number of vehicles on roads. In China, people's preferences for personal vehicles rather than buses is partially because of the bus system's unpredictability. Although dispatch schedules exist, many unexpected conditions occur; sometimes buses are not on time or there are too many people to fit on the bus. Anxious commuters may wait for a while then decide to take a taxi, which adds to the number of vehicles on the road. In China, Hisense developed the only autonomous dispatch system which combined artificial intelligence and big data analytics. It enhances the driving scheme of automatic generation and optimization, as well as automatic processing of unexpected events. The system greatly improves dispatch plans and reduces dispatch errors, which leads to more accurate bus scheduling. After the operation of the system in Chengdu, the efficiency of dispatching personnel increased by 200%, average passenger wait time was reduced from 9 minutes to 5 minutes, the complaint rate of passengers dropped by 20% and the public transportation consumer satisfaction rate of Chengdu also reached as high as 85%, the highest among all industry in the city (Q. Wang [21]). The system acts as a strong catalyst for people to give up personal vehicles and taxis and turn to public transportation, which will ease congestion by effectively reducing the amount of cars on the road.

Artificial Intelligence can solve human-related traffic congestion in two wars, 1) enabling driverless cars and 2) using AI-powered law enforcing robots. The physical limitations of the human body contribute to many car accidents. Drunk driving, drowsy driving, weather conditions, or simply distractions from phones, drinks, or food can lead to accidents. It only takes a few seconds of distraction for car accidents to occur but usually requires at least 10–30 minutes to settle the accidents (J. Zhu [24]). When accidents occur, the damaged vehicles, being unable to move away, directly affect the traffic flow of one or more lanes and cause traffic congestion. The condition is worse when an ambulance and police cars are involved, especially during peak commuting hours. Driverless cars could directly solve these problems due to the characteristics of the machines. Driverless cars rely on artificial intelligence to integrate visual computing, radar, monitoring devices, and global positioning systems to operate vehicles safely and automatically, without any human initiative. In contrast to humans, artificial intelligence will never drive drunk, fatigued, distracted, or over the speed limit. This becomes especially critical when we examine the data. In 2018, 10,511 in 36,560 total traffic fatalities were alcohol-impaired fatalities according to U. S. Department of Transportation, National Highway Traffic Safety Administration ("2018 Fatal Motor Vehicle Crashes" [12]). If 90 percent of cars on U.S. roads become driverless, the number of accidents would fall from 6 million to 1.3 million and the death toll from 33.000 to 11.300 (Wibberley [23]).

With collaboration and investments from companies worldwide, the AI car is steadily developing. For example, Baidu's Apollo had 300 driverless cars on the roads with a total of 1.2 million miles driven by July 2019 (Sivalingam [17]). As a leading automotive company, Audi already unveiled its A8 autonomous driving feature, which not only allows drivers to take their hands off the steering wheel up to 37 mph but also was adapted in 2019 with more advanced object recognition and adaptive cruise control (Davies [8]). It will take time for autonomous cars to become commercially available to consumers, but AI cars are surely the future. Current issues, such as safety concerns, will be steadily overcome as AI technology continues to develop. On the other hand, consumer acceptance of AI cars is very high, at least in China. In a survey I conducted in China with a sample size of 534.86% of the respondents indicated interest in trying AI cars if available on the market.

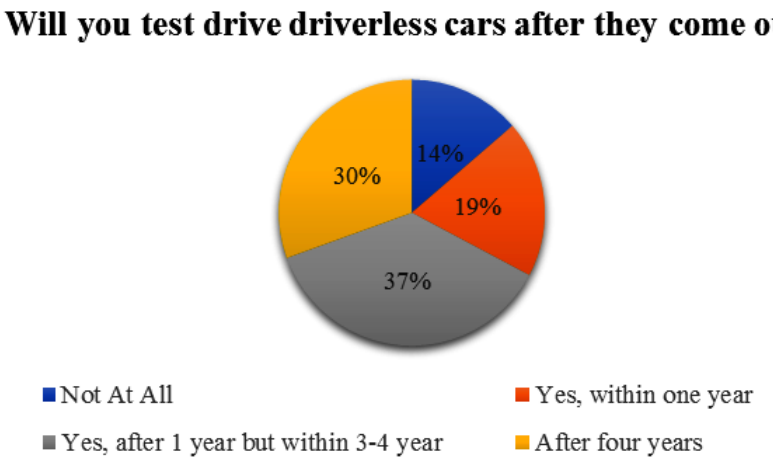

Figure 1. Distribution of Willingness to Try AI Car If Available in Market

Successfully enforcing traffic rules will also ease traffic violations associated with pedestrians and vehicles, therefore resulting in better traffic flow. Pedestrians often run red light and cars often park illegally; these two activities are especially common in big cities where there are too many cars and walkers for police to control, inhibit, or punish. To address this problem, multiple cities in China started to employ AI powered systems. For example, Hangzhou (Zhejiang, China), implemented the AI product, Tianyao, in April 2018. Through automatic tracking identification and intelligent perception technology, Tianyao is equipped with real-time analysis capability similar to city-level large-scale cameras. It holds complete traffic event identification with the ability to discern reverse driving, non-motor vehicle traffic in motor vehicle lanes, pedestrian traffic in motor vehicle lanes, and other traffic anomalies within 20 seconds with 95% accuracy. In 2018, Tianyao controlled a total of 249 monitoring ball machines in the pilot area, which covers nearly 700 sections of roads (the same area would require at least 200 police officers) and monitors the area 24 hours a day, 365 days a year, which cannot be achieved by manual patrols (Y. Zhu [25]). A similar system has been employed by the city of Shenzhen (Guangdong, China), but with more focus on pedestrians. In April 2017, a face recognition system was put into use on a trial road intersection to monitor pedestrians crossing at red lights. This system was proven effective as during the six months of its implementation, 13.930 cases of pedestrian violations were caught and the number of violations decreased from about 150 cases per hour to 8 per hour ("The AI Traffic Police," [19]).

The city of Handan (Hebei, China) employed Robotic Police, which is the newest and most comprehensive AI system used in China. The Robotic Police integrated technology in AI, cloud computing, and multi-sensor fusion to achieve fully autonomous intelligence operations, regardless of weather and or time of day, to assist traffic police and help public services. The Robotic Police has three main types, Road Patrol Robot, Manage & Consult Robot, and Accident Alert Robot, each with a distinctive appearance. They can broadcast reminders, discern and report license plates during the patrol and when capturing violations, identify human faces, alert and expel illegal parkers, and answer questions. A single Robot Traffic Police can work 16 hours a day, and replace 1–2 auxiliary police personnel. It is estimated that one robot can save up to 150.000 yuan (about $21.429) a year (Wang and Chang [21; 22]) The use of AI technology is very promising at alleviating human-related traffic congestion problems.

In the field of technology-related congestion, artificial intelligence is contributing significantly now and will into future. As early as 2017, Baidu map, Google maps and other map apps employed

AI technology. AI powered GPS systems can provide more accurate information about the current road situations and provide better routing for drivers to reduce traffic jams. Among the 534 respondents I surveyed, 68.35% acknowledge maps apps used AI technology, and as many as 98.51% consider the path planning function useful. For those who indicated that function as useful, 68.54% think the app automatically planned the quickest and shortest route after entering one or more destinations, 60.84% think it shows traffic jams areas and provides an opportunity to change the route when needed, 46.07% think it alerts them to road cameras, speed limits, time to turn a corner, and other notifications, only 3.93% choose none of the above.

Another use of AI could be extended to enable smart traffic lights. Most traffic lights in the world have a fixed amount of time to pass for pedestrians and drivers. Since the timing is consistent from the day it is set, traffic lights aren't flexible to the number of cars and pedestrians who are waiting to pass. On the other hand, the smart traffic light with AI would be able to allocate more time to the direction with heavier traffic flow at any given time. This technology is being piloted in areas of the world now. In America, Scalable Urban Traffic Control designed by Stephen Smith and other researchers of the Robotics Institute, Carnegie Mellon University enabled real-time optimization of traffic flow. It analyzes data collected from cameras and sensors to come up with the best phase change and controls the lights accordingly. When tested in nine intersections in the East Liberty region of Pittsburgh in June 2012, and contrasted with the previous condition in March 2012, the results were impressive. Average waiting time at intersections was reduced by over 40%, journey time decreased by 25%, average vehicle speed increased by 34%, number of stops decreased by over 31%, and emission was reduced by 21% (Smith [18]). Because of these results, in the past three years, the program has expanded to 47 intersections in Pittsburg, PA. In China, two cities employed smart traffic light technology and realized the same successful result. The biggest taxi company in China, Didi, cooperated with the traffic police of Jinan (Shandong, China) to employ smart traffic lights in six intersections on Jingshi road which is the longest arterial street in China. Within one month, the work day average delay time decreased by 10.73% during morning peak hours, and 10.94% during evening peak hours. The number of stops also decreased, those in evening peak hours of the work day decreased by 8.7%, and the number of stops in the morning peak decreased by 6.7% (Zhu [24; 25]). In July 2017, Guangzhou traffic police piloted the "Internet + signal lamp" control and optimization platform, and directed the traffic in Guangzhou with the help of the traffic platform Austro-Tech. Before the pilot in the Haizhu district, there was a serious imbalance at the intersection between Nanhua Middle Road and Baogang Avenue. After implementing the system, the congestion was reduced by 25.75% from 9 a.m.– 1 p.m. and by 11.83% from 3 p.m.– 8 p.m. (Qu, 2018).

V. Conclusion

With efficiency, consistency, endurance, and accuracy, artificial intelligence can help solve traffic congestion. Innovation from both the U.S. and China shows that AI is capable of solving traffic congestion through five different approaches: planning, navigation, law enforcement, smart traffic lights, and autonomous vehicles. AI may be the only approach to solve traffic congestions with no side effects and it is very likely that the current initiatives will move from regional experimental tests to extensive national implementation.

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Section 2. Management

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THE STRATEGIC DEVELOPMENT OF INDUSTRIAL ENTERPRISES

Abstract. The article examines the strategic development paths of manufacturing industry as one of the factors contributing to sustainable economic development in the Azerbaijani industry. In addition, the paper explores the strategic development of industrial enterprises and offers a program of measures to address these issues.

Keywords: Sustainable Economic Development, Economic Development Strategy, Socio-Economic Development State Program.

The socio-economic strengthening of our Republic depends primarily on the development potential of industrial enterprises. Achievements in the industrial sector in line with the strategy set out in the Development Concept of "Azerbaijan 2020: Looking to the Future" – macroeconomic stability, dynamic economic growth, reduction of unemployment and poverty, increasing population welfare and economic success in the country. activity. In this context, the country's economic development strategy accelerated the growth of sustainable industrial development. The sustainable economic development of Azerbaijan depends directly on the economic development of the non-oil industry or on the development of a sustainable economic development strategy for the processing industry of many countries.

Of course, along with the petroleum industry, the refining industry plays a major role in the further development of the economy of the Republic of Azerbaijan. It should be noted that manufacturing industry is often one of the key and important factors in determining the structure of each economy. The advantage of the manufacturing industry is that it ensures the growth of every national economy. Therefore, some measures are taken in order to further develop the processing industry in the economy, improve its structure, increase investments in this sector and take appropriate measures in many areas related to this sector. The implementation of these measures has been put forward as an important task aimed at efficient use of production facilities and business resources and proper placement problem for the sustainable development of the processing industry in our country [1].

The socio-economic strengthening of our Republic depends primarily on the development potential of industrial enterprises. The achievements in the industrial sector in line with the strategy set out in the "Azerbaijan 2020: Future Perspective" Development Concept – are the result of macroeconomic stability, dynamic economic growth, reduction of unemployment and poverty, increased population

welfare and economic success activities in the country. In this context, the country's economic development strategy accelerated the growth of sustainable industrial development. The sustainable economic development of Azerbaijan depends directly on the economic development of the non-oil industry or on the development of a sustainable economic development strategy for the processing industry of many countries.

The development of a sustainable economic development strategy in the processing industry will directly contribute to the growth of the industrial sector and ultimately to the economic development of the country. Thus, we can ensure the socio-economic development of the country by creating a strategy for the sustainable economic development of the processing industry. In order to ensure sustainable socio-economic development in the country in the near future, it is important to achieve stable and high growth rates in the processing industry, to improve its structure and to increase its efficiency.

In this context, it is necessary to promote the competitiveness of national product, increase investment and innovation activities in the processing industry and accelerate the development of the non-oil sector and its activities. To this end, it is a current study to investigate the theoretical and methodological aspects of the regulation of processing industry enterprises in the economic development of the Republic of Azerbaijan in a globalized world, to examine the factors affecting economic development in this field and to increase the mechanisms of the sector as a whole in economic development [1].

It is important to note that a comprehensive analysis of the factors affecting the economic development of the Republic and the development of economic mechanisms has become a serious necessity in the processing industry. Apparently, the country's economic growth was largely driven by the oil factor. This is also objective, because in the early years of independence – at a time of difficult financial resources, the oil factor could not come to the forefront.

One of the key points in the sustainable development strategy determined by the Azerbaijani government is that oil is not a purpose but a tool. The future of the economy of the Republic of Azerbaijan is not limited to oil. Therefore, the rapid development of the non-oil sector has been identified as one of the priority areas of economic policies.

In this context, in November 2003, the President of the Republic of Azerbaijan Ilham Aliyev signed the decree "On measures to accelerate the socio-economic development of the Republic of Azerbaijan". As a result of the tasks set out in this historical document, the economic and investment environment has been improved, new production facilities and jobs have been created, and real opportunities for the rapid development of the non-oil sector have been created.

Then, on 11 February 2004, the President of the Republic of Azerbaijan Ilham Aliyev signed a decree on the ratification of the "State Program for the Socio-Economic Development of the Regions of the Republic of Azerbaijan". The State Program envisages the following objectives, which aim to address a number of key issues of great importance to the population of the country:

– ensure a balanced economic development of the country and reduce dependence on the oil factor;

– restructuring and strengthening of inadequacies in social and economic development, ineffective migration processes between regions, creation of new workplaces;

– efficient use of resources by region;

– the creation of regional production and social infrastructure meeting the modern requirements.

In addition, the President approved a series of action plans to accelerate the socio-economic development of many cities and regions in the country. In this context, 83% of the new jobs in the regions and 94% in the non-oil sector were created as a result of the measures taken within the framework of the State Program for Socio-Economic Development of the Regions.

In addition to all these efforts, in order to make the most of the existing potential in the new stage of industrialization, Azerbaijan has become a more powerful industrial center in the region and State Program for the Development of Industry in the Republic of Azerbaijan dated 26 December 2014 for 2015–2020 has been prepared. It was developed and approved by the decision of the President of the Republic of Azerbaijan [2].

The state program aims to modernize and develop the structure of the industry, to increase the export potential of the non-oil industry, to increase the competitive energy-saving, high value-added competition industry, to expand high-tech and innovative production and to train qualified personnel for new industries. To achieve these objectives, the program is being further developed to improve the competitiveness and capacity of the industry, to develop existing industries and to create new industries, to develop the regional structure of the industry, to develop industrial infrastructure, to create industrial zones and clusters, to provide industries with highly skilled human resources and scientific knowledge. 24 directions have been identified, including the strengthening of the regulatory framework and the regulation of the activities of industrial enterprises and others [2].

A number of action plans have been developed as part of this program:

1. To increase the competitiveness and capacity of the sector
2. Support of industrial enterprises
3. Establishment of industrial zones and clusters
4. To strengthen human resources
5. Improvement of legislation

In addition, the following activities will be implemented under this program:

– modernization and improvement of the industrial structure;

– increasing the export potential of the non-oil industry;

– expanding competitive industrial production with energy efficiency and high added value;

– expanding scientific and innovative production;

– organizing qualified personnel training for new industries;

– expanding measures to support industrial production;

– strengthen the potential of traditional industries;

– support the role of existing natural and economic resources in economic development;

– improving the supply of industrial infrastructure;

– encouraging local and foreign investments in the non-oil sector;

– implementing measures for the transfer and assimilation of advanced technologies;

– encouraging the implementation of modern enterprises and corporate governance principles in industrial enterprises;

– promoting standardization and certification in industrial enterprises;

– supporting the branding, marketing and advertising activities of industrial enterprises;

– creating healthy and safe jobs in industrial enterprises;

– creating technological chains with the participation of the private sector in the direction of industrial development before the production of final products;

– supporting the creation of new industries;

– strengthening the industrial potential of the regions;

– creating new regional development centers, special economic zones, industrial production clusters in priority areas and new local enterprises based on the competitive advantages of each zone and economic zone;

– establishing the industrial and technology parks and industrial zones;

– enhancing cooperation between the public and private sectors with a purpose to developing the non-oil sector;

– support the establishment of appropriate initiatives with the use of low waste or wastewater technologies for waste saving, efficient use of natural resources and environmental protection;

– strengthening state support for the expansion of innovation activities;

– encouraging the use of innovative technologies in industrial enterprises.

At the same time, attention should be paid to the sustainable economic development of the processing industry, particularly the machinery manufacturing industry, during the implementation of the State Program and measures should be taken to increase the share of manufactured products and equipment in meeting domestic demand. If heavy industry enterprises need to produce basic products for the industry, close involvement of the government should be ensured and the private sector should provide market with semi-finished products and final products [2].

The successful implementation of the tasks defined in the main aspects of the state's economic policy gives the firm confidence that the independent Azerbaijani state will be in sustainable development and worthy of place in the globalized world.

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Section 3. Population Economics and Demography

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OPTIMIZATION MODEL FOR ALLOCATION OF HOSPITAL BEDS UNDER THE TREND OF AGING POPULATION

Abstract. Currently, there is an increasing trend for the demand for hospital beds. Due to the increasing cost of healthcare services and the aging of the population, hospitals need to pay more attention to integrate resource management and hospital bed allocation. In this study, Gini coefficients and Lorenz Curve are used to predict the aging of the population, which helps to build up the supply and demand curve of the hospital beds in the long run. The Erlang Loss Formula is used to analyze the patient flow in the region with the different situations of the area and the need for medical care. The Logistics model is used to predict the future outcome of the allocation of hospital beds. In the next step, the optimization model is proceeded to get the optimal arrangement of hospital bed allocation.

Keywords: Economics, aging of the population, medical sector, hospital bed allocation, optimization model.

Introduction

As human diseases are becoming increasingly complex, the need for specialist medical consultation along with creative ways to allocate resources such as hospital beds is essential. Human Resources are seen as one of the most costly and complex components that are now facing the health care industry. For instance, poor management would result in inequitable health results fort rural population, high risk, and remote area communities. However, the most vulnerable populations, such as the aging population might be the most affected if the resources are not effectively distributed [7]. As much as emerging diseases and complex clinical conditions warrant greater requirement for specialized are. It is crucial to note that the distribution and quantity of medical resources. For example, hospital beds have been a major problem. In contemporary society, there is a growing trend for the demand for hospital beds. Because of the increasing healthcare services cost and the increment in the number of the aging population, it is imperative for healthcare services and facilities to concentrate on integrating hospital bed allocation and resource management [10]. The employment of hospital beds should be taken into account as one of the primary elements of the public health care system. The concept of hospital allocation has raised a growing number of debates among economists for several years. There is a need to exploit and develop an efficient and practical technique that can be employed in the allocation of clinical beds [7]. When hospitals do not have enough beds, there have been practical situations where patients have to suffer or hare beds. For this reason, using beds relevantly and saving resources is of importance for the advancement of the

health care industry and the progress of the economy [10]. A literature review and analysis of previous studies on the creation of the optimization model that can be employed in dealing with this problem should be examined so as to identify any potential gaps and how to improve on the current situation.

Background Information

With the gradual aging population coupled with the current deficits in hospital beds in specific developed locations, there is a need to excavate the seriousness of this matter with the help of optimization and prediction models. Efficient hospital bed allocation in a certain health facility requires not only demand information, such as hospital expansion or patient complexity, but it also requires the willingness of the facility and the government to invest and allocate a certain amount to unanticipated sites [14]. As much as this issue has been a common happening in the public health care system, evidence and proof revolving around how to promote an efficient hospital bed allocation have been lacking for decades [6]. The world is aging. In several countries, the changes in the population age mix require an increased demand for resources and expensive health care. In the contemporary world, there has been an occurrence of moral conflicts as a result of resource allocation for health. With the growing magnitude of limited resources and health inequalities, there is need to develop a framework and optimization model that will ensure that the priorities of the management when allocating this resources among the aging population are based on the impact programs, policies, actions on health, projects and knowledge of the aging population's health situation [7]. The actors in the health industry that are involved in the allocation of resources, such as beds, especially the physicians and the managers are expected to make informed decisions based on the scarcity of real resources and the baseline that it is morally right to allocate them in such issues. To deal with these situations, there is a need to develop an optimization model that can reflect the clinical complexity, diversity, and hospital bed needs for the aging population in a healthcare setting.

Literature Review

Physician's engagement is a concept that is commonly employed for ensuring that physicians can collaborate with other healthcare stakeholders to leverage the quality of care and the experience of patients on a continuous basis.it is determined by the increase in the level of satisfaction and loyalty to their hospital facilities, quality improvement and alignment of key costs [6]. In this case, the physicians are engaged under such circumstances ae those that are committed to ensuring that the mission of their facility is achieved and are willing to assist the health care organization when needs. Apparently, such commitment is crucial to the overall performance of the company. To develop a proper hospital bed optimization model, there is need to first ensure the physicians and healthcare specialists are willing to attend to more paging patients that are assigned to them.

Many healthcare facilities have been successful in using shared resources within a certain hospital network or reallocating resources within a merged network to deal with the challenge of limited resources. A research on the results of acquisitions and mergers in healthcare facilities and established that the rates of mergers are related to cost savings when it comes to lower occupancy facilities [9]. On the other hand, demonstrated that the merger of four branches played a crucial role in reducing the costs of operations by ensuring that the occupancy rates are curbed. Moreover, postulations that the placement models are one of the prominent for the provision of sanitation services and a growing number of studies have purposed to curb costs of traveling [8].

Efficient resource allocation such as hospital beds across the healthcare facility in a network needs not only information demand, but it is possible to apply linear programming in developing an optimization model that can be used to allocate resources such as beds, dentists, doctors to fit the requirements of the hospital as well as in disaster or emergency situations. For instance, attempts to allocate dentists, physicians and nurse have been established via mobile health ser-

vices while Tanner conducted a research on the allocation of transport facilities in a case of emergency using linear programming [11]. However, it is imperative to note that there has been no research that has been able to develop an optimization model on the allocation of hospital beds among the aging population. In Freitas and Schramms's research, they performed a four-rounded modified Survey that took into account all the hospital executives to help in the identification of potential determinants of resource allocations among the aging populations and some of the factors that might influence decisions about their allocation based on the demand areas [7]. The author developed a questionnaire based on 40 primary areas identified from published literature and reviewed by private and public experts to guarantee face validity. The findings of this research exemplified the employment of the Linear Programing technique in the optimization of resource allocation in a healthcare facility and large hospital network. A number of research works have employed linear programming in resource allocation, but they only concentrated on mapping the requirements of the patients based on the available resources. Yet, heuristic principles should be taken into account when making decisions since not only mathematical models can be important in developing an optimizing model for the allocation of resources.

Mathematics & Modeling

Assumptions:

- People's incentive to maximize their profit and utility holds true in the experiment conducted in this paper;
- One bed can only be used by one patient at a time, but all beds can be allocated between departments;
- Hospital beds are given to patients with the most serious or emergency situation first, with the hierarchy of demand going from the most severe to the least;
- All hospital beds discussed in this paper are of the same type, function, and are used in the same way;
- All arbitrary cases are negligible in the experiment conducted in this paper.

Table 1.– Input Variables:

Variable Symbol	Variable Name
1	*2*
S_U	Different States within the United States of America
FI_S	Patient Inflow in State S
FO_S	Patient Outflow in State S
A_S	Average Number of Admissions in State S
LOS_S	Average Length Of Stay in State S
T_S	Average Wait Time in State S
P_S	Population Age (Median) for State
N_H	Number of Nurses in Hospitals in Each State
D_H	Number of Doctors in Hospitals in Each State
S_H	Number of Other Staff Members in Hospitals in Each State
H_S	Hospital Departments of Hospitals Across States
B_H	Maximum Number of Beds Available in Each State
E_S	Economy/Real GDP of Each State

1	*2*
L_S	Local Wealth Base in Each State
G_S	Gini Coefficient of Each State
U_S%	Unemployment Rate of Each State
R_H	Daily Rotations of Nurses Hospitals in Each State

Table 2.– Output (used for decision variable):

S_A	**Allocation System of Hospital Beds**
BOR_S	Bed Occupancy Rate in State S
CPI_S	Consumer Price Index in Each State
OC_D	Operating Cost in Each Hospital Department
TOC_S	Total Operating Cost in Hospitals of State S
MHS_S	Medicare Hospital Spending Per Patient
I_W	Index of wages and earnings
P_S	Probability Mass of Observing X admissions of State S

Table 3.– Parameters:

Parameter Symbol	**Parameter Name**
OCN_{ik}	Economic Cost of reallocation of $k \in N$ nurses in state $i \in H_S$
OCD_{ik}	Economic Cost of reallocating $k \in D$ doctors in state $i \in H_S$
OCS_{ik}	Economic Cost of reallocation of $k \in S$ other staff members in state $i \in H_S$
OCB_{ij}	Economic Cost of rearranging $j \in B_H$ hospital beds in state $i \in H_S$
P_i	The maximum capacity of patients in hospital $i \in H_S$
BP_i	Maximum number of beds can be allocated in hospital $i \in H_S$
DA_{ik}	Maximum number of $k \in D_H$ doctors can be allocated in hospital in state $i \in H_S$ without losing function
DN_i	Maximum number of $k \in N$ nurses can be allocated in hospital in state $i \in H_S$ without losing function
DS_i	Maximum number of $k \in S$ other staff members can be allocated in hospital in state $i \in H_S$ without losing function

List of Formulae & Models:

a) Aging of population and Economy:

- Gini Coefficient
- Lorenz Curve
- Phillips Curve;
- Demand & Supply Curve for the Market in Hospital Beds

b) Reallocation of Hospital Beds based on the aging of population and economy:

- Logistics Model for the prediction of future patient flow
- Convolutional Neural Network to help level up the efficiency of Logistics Model by adding artificial intelligence training components into it
- Linear Regression

– For predicting future flows of GDP, Gini Index, and Population Median Age, the autoregressive model based on time series will be:

– GDP: $E_S = \beta_0 + \beta_1 E_{s-1} + \beta_2 E_{s-2} + \beta_3 E_{s-3} + \beta_4 E_{s-4} + + \ldots + \beta_k E_{s-k} + \varepsilon_S$.

– GINI Index: $G_S = = \beta_0 + \beta_1 G_{s-1} + \beta_2 G_{s-2} + + \beta_3 G_{s-3} + \beta_4 G_{s-4} + \ldots + \beta_k G_{s-k} + \varepsilon_S$.

– Population Median Age: $P_S = \beta_0 + \beta_1 P_{s-1} + \beta_2 P_{s-2} + + \beta_3 P_{s-3} + \beta_4 P_{s-4} + \ldots + \beta_k P_{s-k} + \varepsilon_S$.

- Erlang Loss Formula A&B&C

– In order to calculate and quantify the load of the hospital system, we need to use the Erlang Loss Formula. The formula will involve the following variables: Patient Inflow PI_S, Patient Arrival Rate;

– Assumptions: Infinite Population, infinite resources;

– Epidemics are very extreme situations in which aren't considered in this experiment;

– Hospital Beds – servers, patients – subscribers;

– Parameters: Patients being asked to stay in hospitals;

– Hospital Bed Occupancy Rate;

– Waiting Time → two scenarios: 1. Waited, derived the bed, 2. Waited, cannot get the bed;

– Compare the traffic derived from the formula with the expected value.

- Network Furl Model;
- Linear Optimization Model.

Table 4. – Neural Network Model: Input Variable

Variable Symbol	Variable Name
S_U	The different States within the United States of America
P_S	Population Age (Median) for State
E_S	Economy/Real GDP of Each State
L_S	Local Wealth Base in Each State
G_S	Gini Coefficient of Each State
$U_S\%$	Unemployment Rate of Each State

Table 5. – Output Variable

CPI_S	Consumer Price Index in Each State
OC_D	Operating Cost in Each Hospital Department
I_W	Index of wages and earnings

Table 6. – Parameters

OCN_{ik}	Economic Cost of reallocation of $k \in N$ nurses in state $i \in H_S$
OCN_{ik}	Economic Cost of reallocating $k \in D$ doctors in state $i \in H_S$
OCS_{ik}	Economic Cost of reallocation of $k \in S$ other staff members in state $i \in H_S$
OCB_{ij}	Economic Cost of rearranging $j \in B_H$ hospital beds in state $i \in H_S$

For the input variables and parameters, as it can be seen from the below (Figure 1), the trend of the median age of main UN regions is generally sloping upward, meaning that the median age is going to increase over time. Of the set of six sub-graphs, the first shows that the proportion of old-age is augmenting as time goes on, which indicates that the overall population is gradually aging. It is a tumor resting inside the heart of this very world, that needs to be removed.

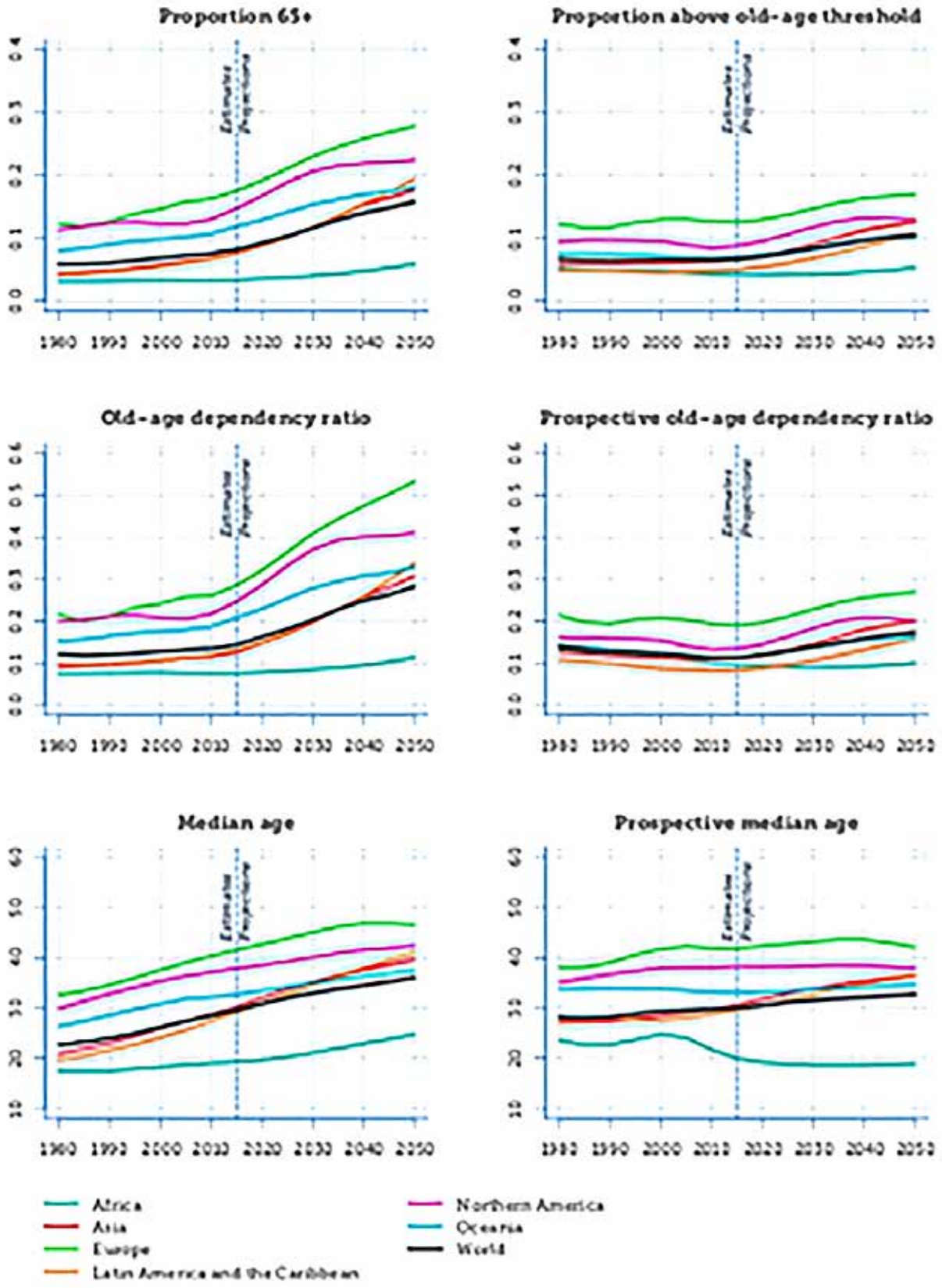

Figure 1. Overview main UN regions. Aging Demographics Data Sheet 2018 with the Overview of Main UN regions [1]

From this statistics graph of (Figure 2) below, we can see that out of all the states in the United States of America, the following states are undergoing an aging population more severe of others (in alphabetical order): Connecticut, Florida, Maine, New Hampshire, Pennsylvania, Vermont, West Virginia. Further in the research, we will see more indicators that will demonstrate the negative effects of the aging population. On the other hand, there are also some states that have exceptionally "young" population, such as (in alphabetical order): Alaska, California, District of Columbia, Georgia, Idaho, Louisiana, Mississippi, Nebraska, Nevada, New Mexico, New Dakota, Oklahoma, Utah, and Washington. Deeper into the paper, we will explore whether this is a good sign for the hospital bed system and the economy.

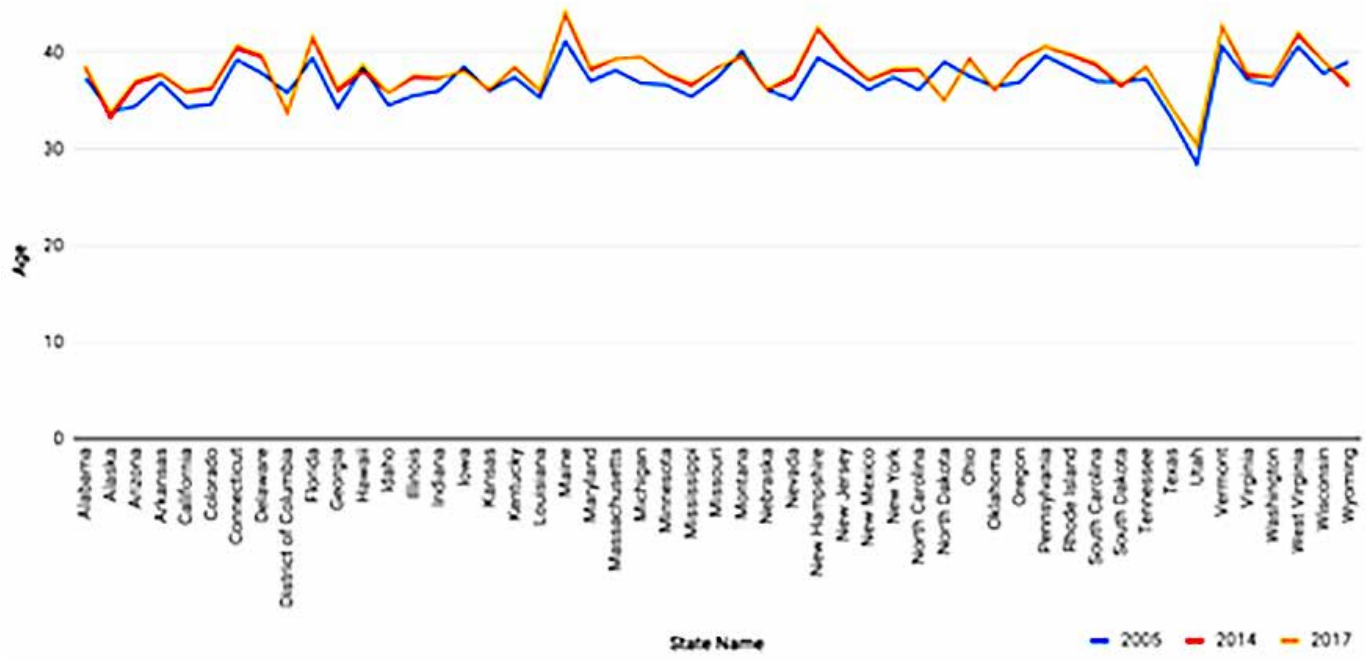

Figure 2.Population median Age By Stat.
Comparison Chart of the Average Age in Each USA State [2]

Economy Section of Research:

Analyzing GDP:

The summary table below (Table 5. Summary Table of GDP by States from 2000 to 2018) and figure (Figure 3. Gini Coefficient by all USA State from 2006 to 2014) show that there's a strong correlation between time and GDP growth, meaning that most of the states, if not all, have achieved certain real GDP growth (economic growth). According to the macroeconomic concept of Purchasing Power Parity, people's purchasing power in each state levitated as a result of increasing real GDP. The effect of that, assuming Keynesian thinkings apply, will bring the state economy to a whole new level where people's life standard is significantly higher than they were a couple of years ago.

Note: The figures and tables below are conducted by the author alone via tools like Google Sheets and R software. The data are sourced from governmental websites cited in the references and footnotes.

Table 5.– [2] Summary Table of GDP by States from 2000 to 2018

```
> summary(GDPState[,2:20])
      2000            2001            2002            2003            2004
 Min.   :  17205   Min.   :  18661   Min.   :  19116   Min.   :  21028   Min.   :  22666
 1st Qu.:  50229   1st Qu.:  51308   1st Qu.:  53367   1st Qu.:  57137   1st Qu.:  61934
 Median : 117258   Median : 119301   Median : 124160   Median : 130337   Median : 136238
 Mean   : 199734   Mean   : 206187   Mean   : 213114   Mean   : 223245   Mean   : 237995
 3rd Qu.: 252359   3rd Qu.: 261714   3rd Qu.: 270732   3rd Qu.: 283790   3rd Qu.: 299076
 Max.   :1366561   Max.   :1384111   Max.   :1436431   Max.   :1527294   Max.   :1632217
      2005            2006            2007            2008            2009
 Min.   :  23509   Min.   :  24310   Min.   :  24697   Min.   :  25678   Min.   :  25868
 1st Qu.:  66176   1st Qu.:  69896   1st Qu.:  72903   1st Qu.:  75294   1st Qu.:  73855
 Median : 143663   Median : 155153   Median : 161512   Median : 165189   Median : 160641
 Mean   : 254065   Mean   : 269254   Mean   : 281683   Mean   : 286695   Mean   : 281388
 3rd Qu.: 320843   3rd Qu.: 339217   3rd Qu.: 363160   3rd Qu.: 370866   3rd Qu.: 359612
 Max.   :1753866   Max.   :1874737   Max.   :1955856   Max.   :1990678   Max.   :1920062
      2010            2011            2012            2013            2014
 Min.   :  27108   Min.   :  28135   Min.   :  28887   Min.   :  29099   Min.   :  29714
 1st Qu.:  76093   1st Qu.:  78554   1st Qu.:  80592   1st Qu.:  82100   1st Qu.:  85234
 Median : 164606   Median : 170621   Median : 176302   Median : 183015   Median : 194060
 Mean   : 291924   Mean   : 302576   Mean   : 315368   Mean   : 326893   Mean   : 341331
 3rd Qu.: 376089   3rd Qu.: 390322   3rd Qu.: 409860   3rd Qu.: 426031   3rd Qu.: 445703
 Max.   :1974614   Max.   :2050057   Max.   :2144497   Max.   :2262771   Max.   :2396552
      2015            2016            2017            2018
 Min.   :  30709   Min.   :  31635   Min.   :  32623   Min.   :  33725
 1st Qu.:  86829   1st Qu.:  88435   1st Qu.:  91641   1st Qu.:  95731
 Median : 203323   Median : 212675   Median : 221896   Median : 230354
 Mean   : 355046   Mean   : 364594   Mean   : 379845   Mean   : 399713
 3rd Qu.: 472285   3rd Qu.: 491563   3rd Qu.: 508135   3rd Qu.: 531229
 Max.   :2558171   Max.   :2663396   Max.   :2809922   Max.   :2968118
```

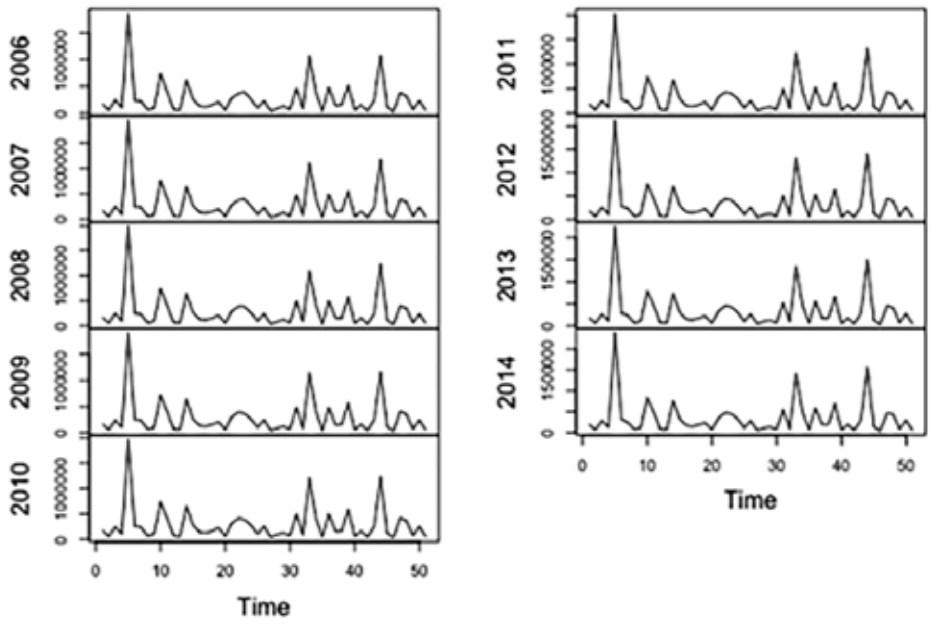

Figure 3. GDP State [8:16]. Gini Coefficient by all USA States from 2006 to 2014 [2]

Gini Coefficient. Analysis Graph:

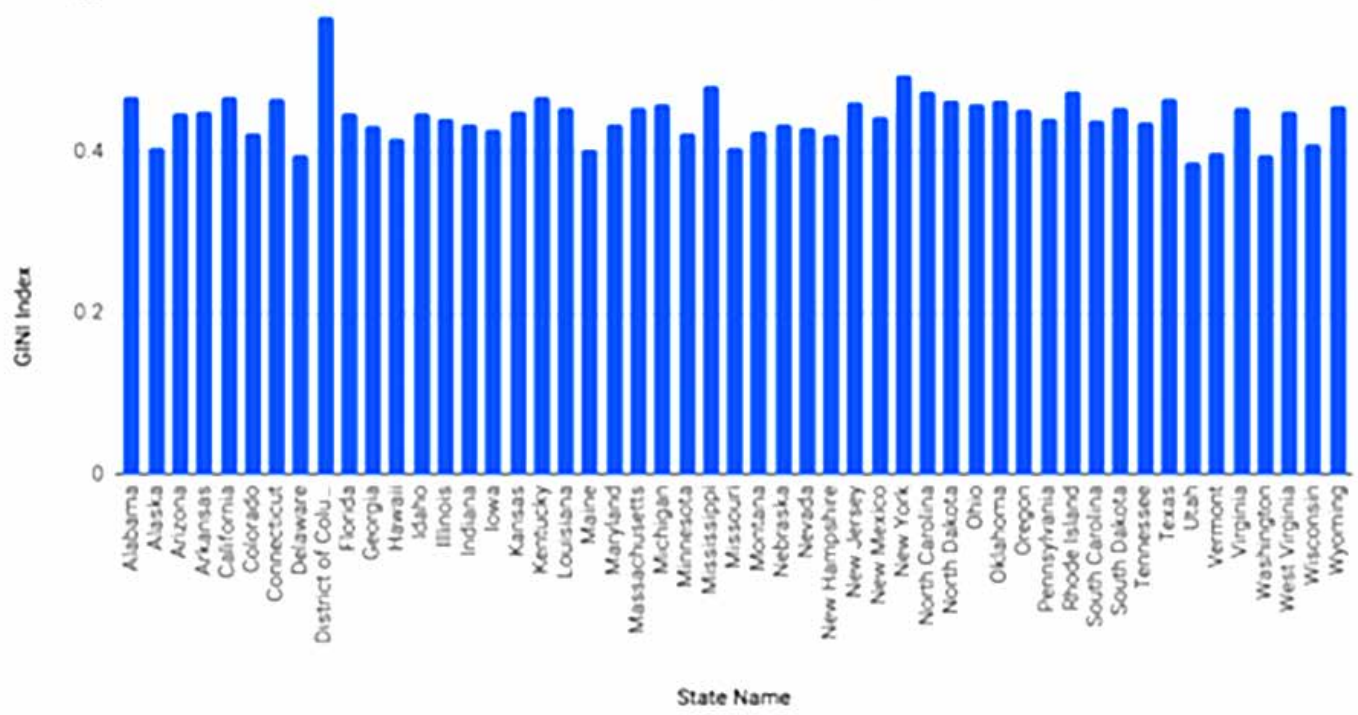

Figure 4. Gini Coefficient by all USA States in 2000 [2]

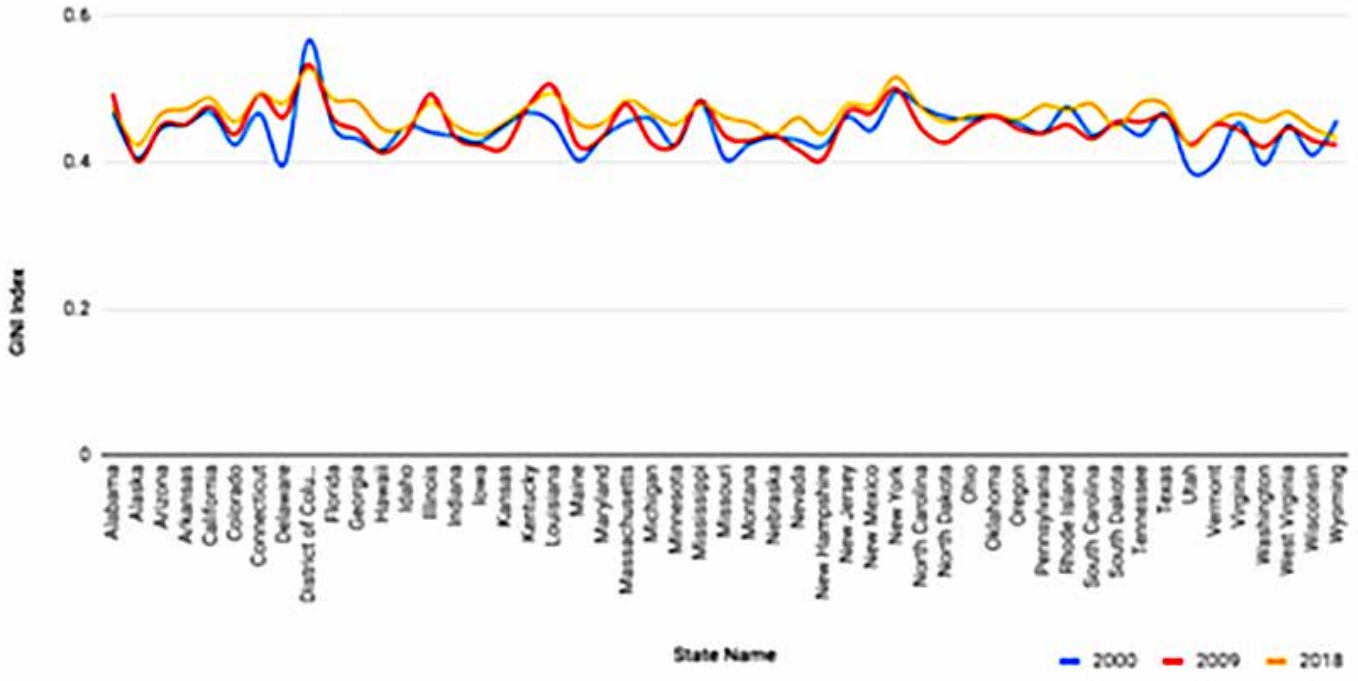

Figure 5. Gini Coefficient by all USA States in 2000, 2009 and 2018 [2]

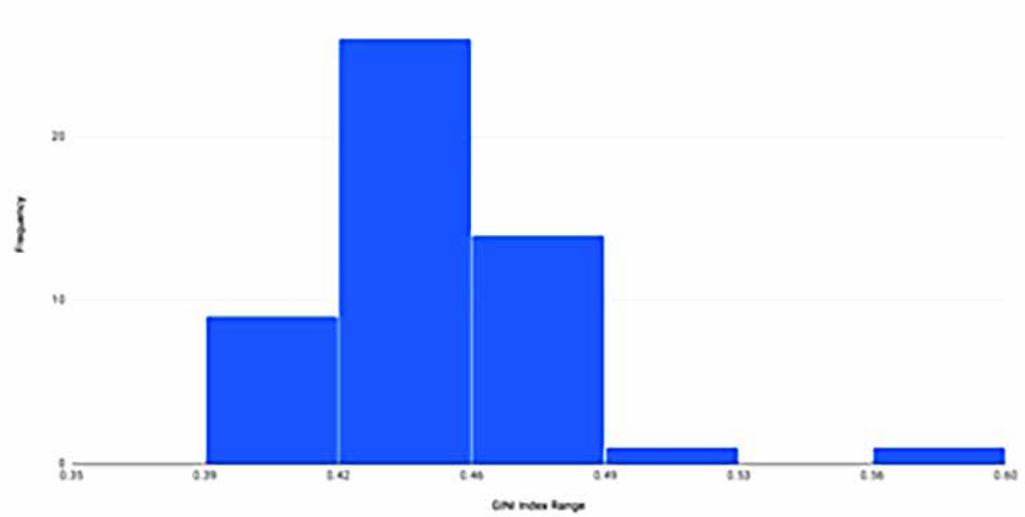

Figure 6. Histogram of GINI Index in 2000 [2]

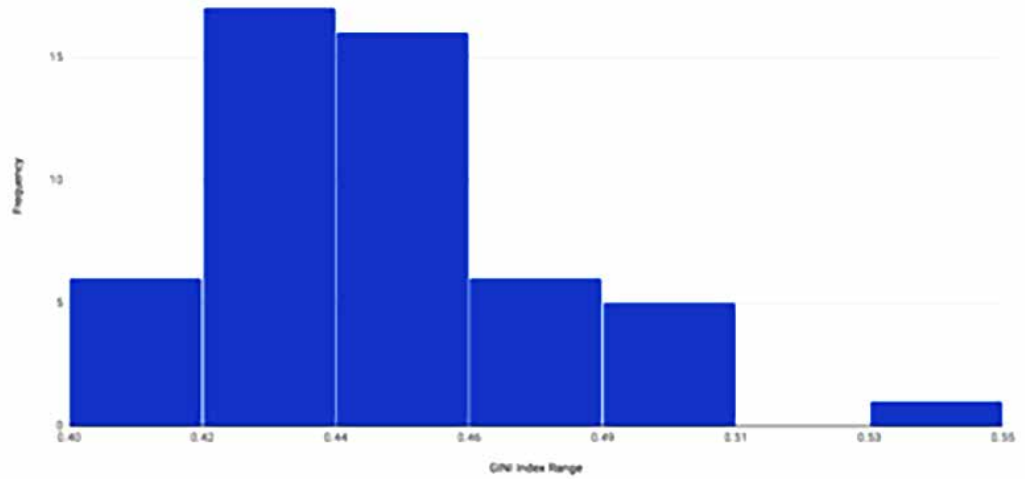

Figure 7. Histogram of GINI Index in 2009 [2]

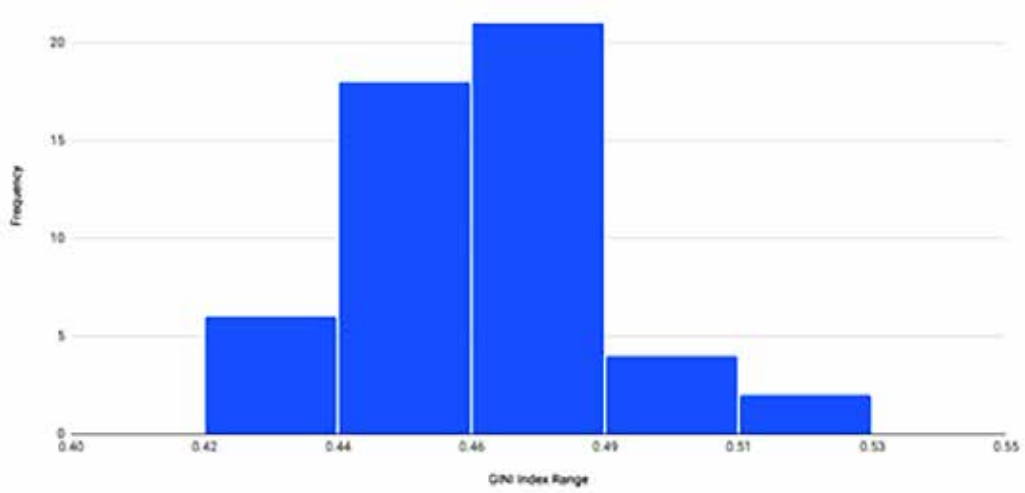

Figure 8. Histogram of GINI Index in 2018 [15]

Combining the above histograms (Figure 4 to Figure 8), we can observe a general trend of the overall Gini Index by state. In 2000, where an economic boom is circulating around the states, most of the states possess a GINI index around 0.42~0.45.

Projected Bed Value Formula proposed by National Health Service (NHS) [15]:

$$Beds = Activity \times \frac{(LOS + TOI)}{365}$$

Where, LOS = Length of Stay, TOI = Turn Over Interval, Activity = frequency of bed occupation

According to historic data distribution(Figure 9 and Figure 10) below, it can be seen that the average number of patient arrivals in a typical ICU unit of a hospital is around 3 patients in every 2 hours, which equalizes 36 patients in every 24 hours. From that, we can conclude that the average patient arrival rate is 1.5 patients per hour.

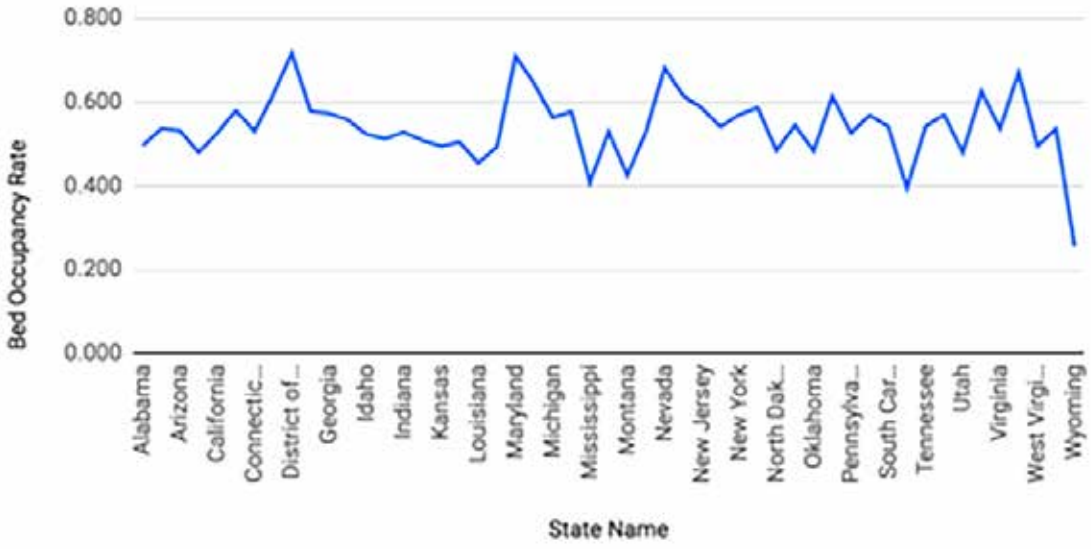

Figure 9. Bed Occupancy Rate By State in 2018 [5]

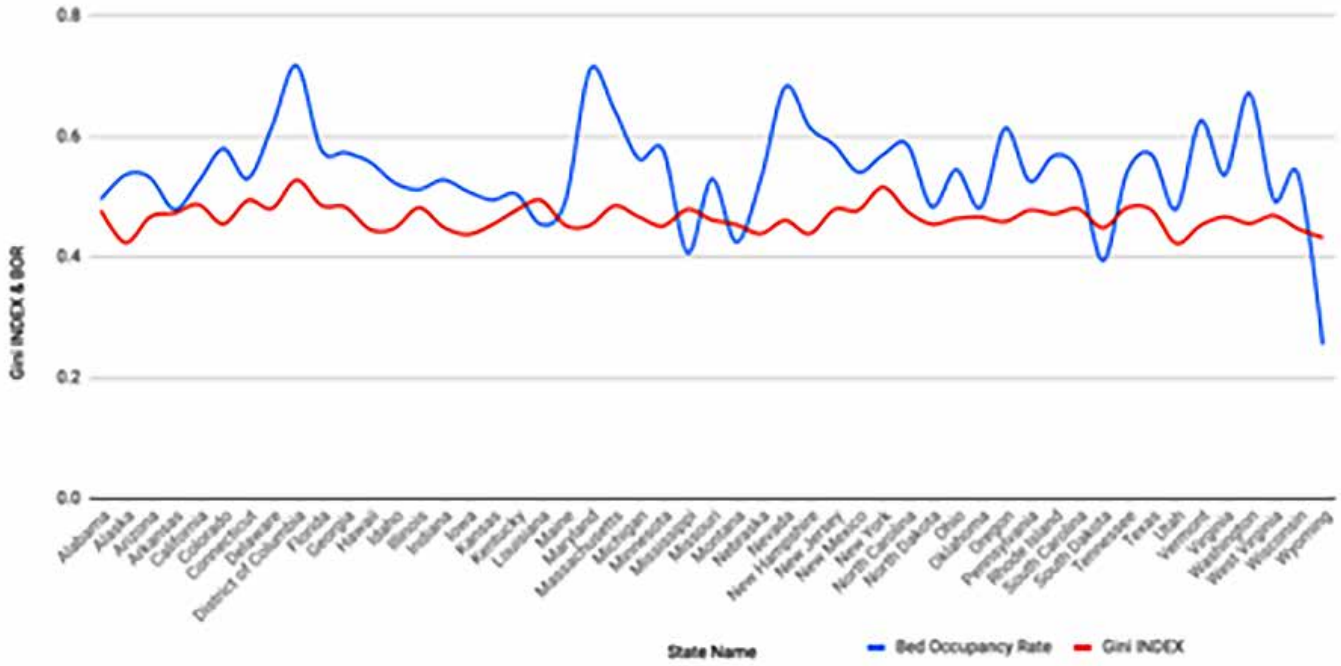

Figure 10. Comparison Chart between Gini Index and Bed Occupancy Rate By State [5]

According to historic data distribution, we've seen that the average number of patient arrivals in a typical ICU unit of a hospital is around 3 patients every 2 hours, which equalizes 36 patients every 24 hours. From that, we can conclude that the average patient arrival rate is 1.5 patients per hour.

Poisson Distribution Model:

The Poisson distribution model in this study measures the probability of having x admissions of hospitals in each state by using the mean admissions (λ_s) of hospitals by state:

$$P_S = \frac{\lambda_s^x \times e^{-\lambda_s}}{x!}$$

Integrating data and executing the model, we find, for example:

Due to high amounts of graphs generated, the following states are considered representatives of other states in the United States of America because: among all fifty states, the state has extremely above-the-average admissions, the state has approximately average admissions, the state has significantly below-the-average admissions.

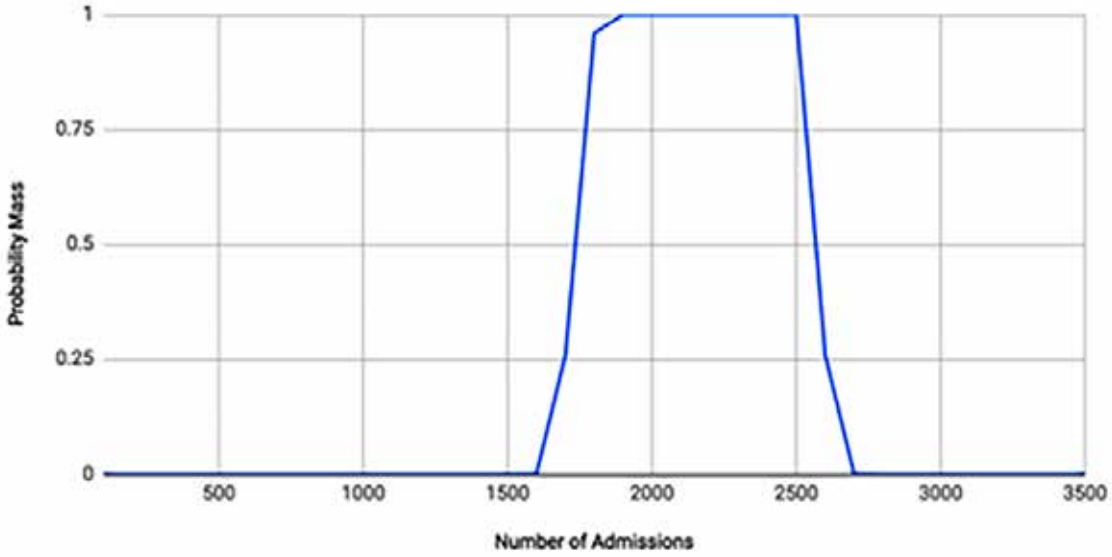

Figure 11. Poisson Distribution of Number of Admission of State of Alabama on a Daily Basis [5]

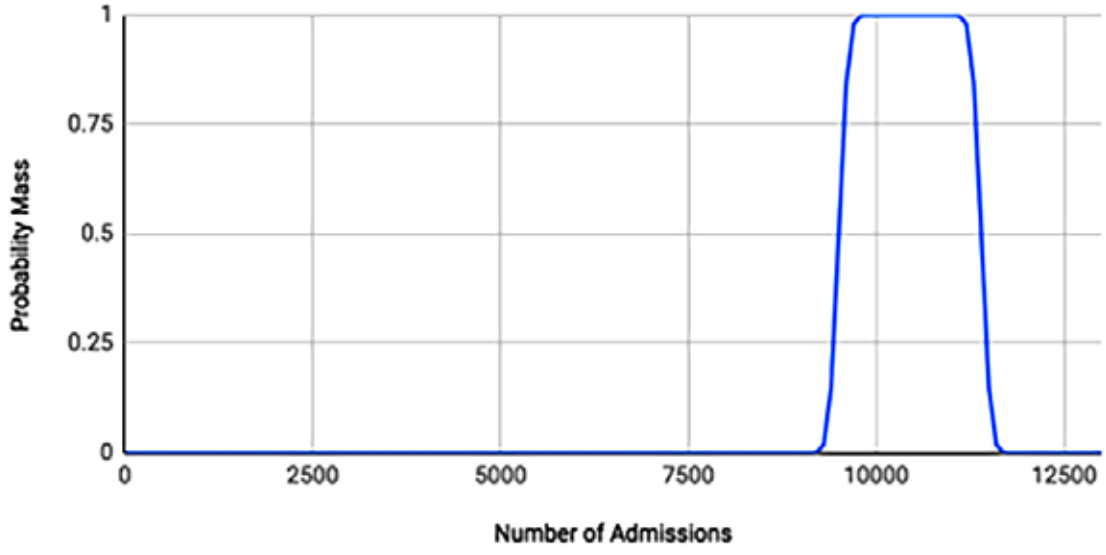

Figure 12. Poisson Distribution of Number of Admission of State of California on a Daily Basis [5]

Table 6.– [5] Sample Data Distribution for California (λ_s = 9502.209123)

Occurrences	Probability Mass
8700	0
8800	0
8900	0.0000000002212608526
9000	0.0000001043468685
9100	0.00001671061216
9200	0.0009354648732
9300	0.01899688839
9400	0.1483470161
9500	0.4936874469
9600	0.8433452085
9700	0.9787644792
9800	0.9988402326
9900	0.9999754157
10000	0.9999998008
10100	0.9999999994
10200	1
10300	1
10400	1
10500	1
10600	1
10700	1
10800	0.9999999994
10900	0.9999998008
11000	0.9999754157
11100	0.9988402326
11200	0.9787644792
11300	0.8433452085
11400	0.4936874469
11500	0.1483470161
11600	0.01899688839
11700	0.0009354648732
11800	0.00001671061216
11900	0.0000001043468685
12000	0.0000000002212608526
12100	0
12200	0

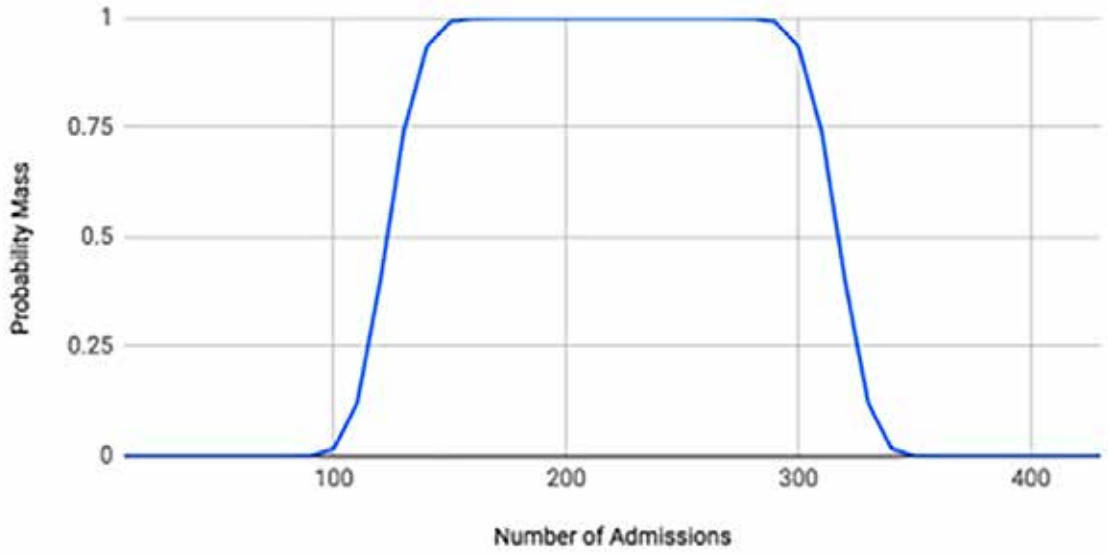

Figure 13. Poisson Distribution of Number of Admission of State of Wyoming on a Daily Basis [5]

Due to the fact that a significant amount of patients require, below values are used for the function of Erlang loss, which can be seen in the below Table. The minimum value of bed occupancy rate is in the state of Wyoming whose bed occupancy rate is 0.255; the maximum value of bed occupancy rate is in the District of Columbia whose bed occupancy rate is 0.717; the bed occupancy rate of New Mexico is closest to average with the value of 0.541.

In those less developed areas/states, it is shown that average patient visits per hour are significantly higher than those more developed. To make matters worse, those hospitals in less developed areas tend to have longer wait times.

Table 7.– [5] Bed Occupancy Rate for all the States in the USA

State Name	Bed Occupancy Rate
1	*2*
Alabama	0.496
Alaska	0.537
Arizona	0.532
Arkansas	0.479
California	0.526
Colorado	0.580
Connecticut	0.530
Delaware	0.618
District of Columbia	0.717
Florida	0.578
Georgia	0.573
Hawaii	0.558
Idaho	0.524
Illinois	0.512

1	*2*
Indiana	0.528
Iowa	0.509
Kansas	0.495
Kentucky	0.505
Louisiana	0.454
Maine	0.493
Maryland	0.710
Massachusetts	0.644
Michigan	0.563
Minnesota	0.577
Mississippi	0.407
Missouri	0.530
Montana	0.425
Nebraska	0.529
Nevada	0.682
New Hampshire	0.615
New Jersey	0.586
New Mexico	0.541
New York	0.570
North Carolina	0.587
North Dakota	0.484
Ohio	0.545
Oklahoma	0.483
Oregon	0.614
Pennsylvania	0.526
Rhode Island	0.568
South Carolina	0.542
South Dakota	0.394
Tennessee	0.542
Texas	0.570
Utah	0.479
Vermont	0.626
Virginia	0.536
Washington	0.672
West Virginia	0.495
Wisconsin	0.537
Wyoming	0.255

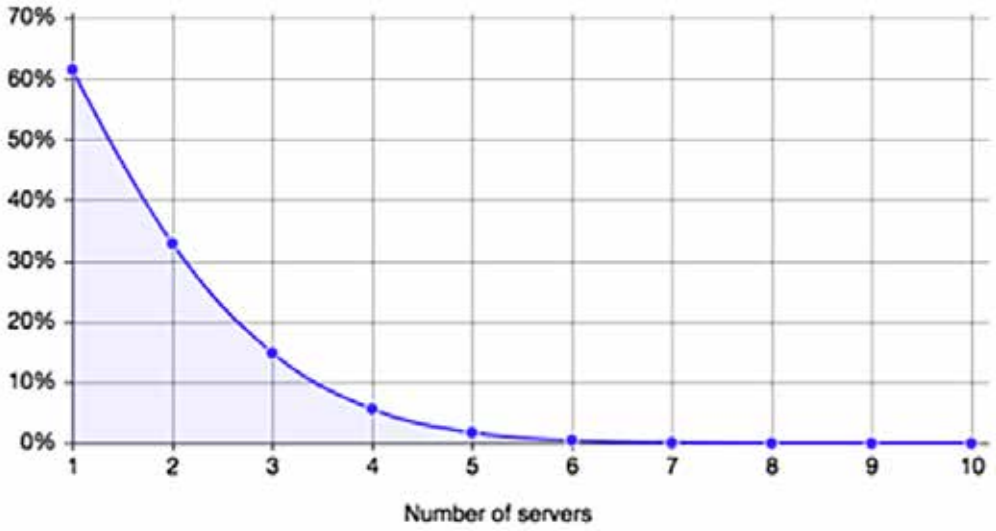

Figure 14. Erlang Blocking Probabilities of x a Patient Entering a Hospital under different number of servers [5]

The Erlang Blocking Probabilities of A Patient Entering a Hospital under the different numbers of servers can be seen in (Figure 14) below.

The Network Flow model is used in the evaluation to minimize the average total cost of operating hospital beds. From the calculations and graphic representation of the Gini Coefficient and the models, we can see that the current hospital bed management system is, to some extent, somewhat efficient. However, this only applies to those states where the GDP is comparatively high and the GINI Coefficient/Lorenz Curve is low and stable. In the states where there is a large gap between the rich and the poor like the District of Columbia, the current system that is running in the medical section of the government isn't at its optimum capacity.

The average total cost(dollars) for the operation of hospital beds in each state before and after optimization has been presented in (Table 8) and Table 5 respectively. The comparison chart has also been provided in Figure 15. The histogram charts for the average total cost of operation (dollars) for the operation of hospital beds for all the states in the USA before and after the optimization are presented in (Figure 16 and Figure 17) respectively.

Table 8.– [3] Summary Table of Average Total Cost (Dollars) for the Operation of Hospital Beds in Each State of the USA Before and After Optimization

Average Total Cost (Dollars)		
1	***2***	***3***
States	Raw Data	After Optimization
Alabama	58879073	54168747
Alaska	5203676	4865437
Arizona	76973790	73125101
Arkansas	26221776	24648469
California	429446770	416563367
Colorado	63807390	58702799
Connecticut	37809922	35919426
Delaware	7242217	6800442

1	*2*	*3*
District of Columbia	12057165	10128019
Florida	317798920	286019028
Georgia	100089929	89080037
Hawaii	7785550	7240562
Idaho	12093793	10521600
Illinois	143676465	129308819
Indiana	78714176	73991325
Iowa	31789578	29246412
Kansas	31789578	30517995
Kentucky	56632631	53574469
Louisiana	54387626	48404987
Maine	10890862	9583959
Maryland	18592438	17272375
Massachusetts	65190065	63886264
Michigan	91688720	87104284
Minnesota	44048408	40084051
Mississippi	34477291	31029562
Missouri	71510458	66647747
Montana	7218737	6135926
Nebraska	13688823	12183052
Nevada	43301063	40269989
New Hampshire	12484187	10861243
New Jersey	123991272	116923769
New Mexico	17358825	15970119
New York	236602658	228321565
North Carolina	97970172	93071663
North Dakota	8225841	7403257
Ohio	141320494	131428059
Oklahoma	44334858	38127978
Oregon	27243728	25418398
Pennsylvania	197599002	185743062
Rhode Island	9837614	9345733
South Carolina	56901031	51779938
South Dakota	10990938	9924817
Tennessee	81319711	74163576
Texas	316275251	299512663
Utah	18852122	17532473
Vermont	4341232	3863696
Virginia	79435741	72127653
Washington	62824835	58112972
West Virginia	18528528	17250060
Wisconsin	52700867	48484798
Wyoming	2847221	2519791

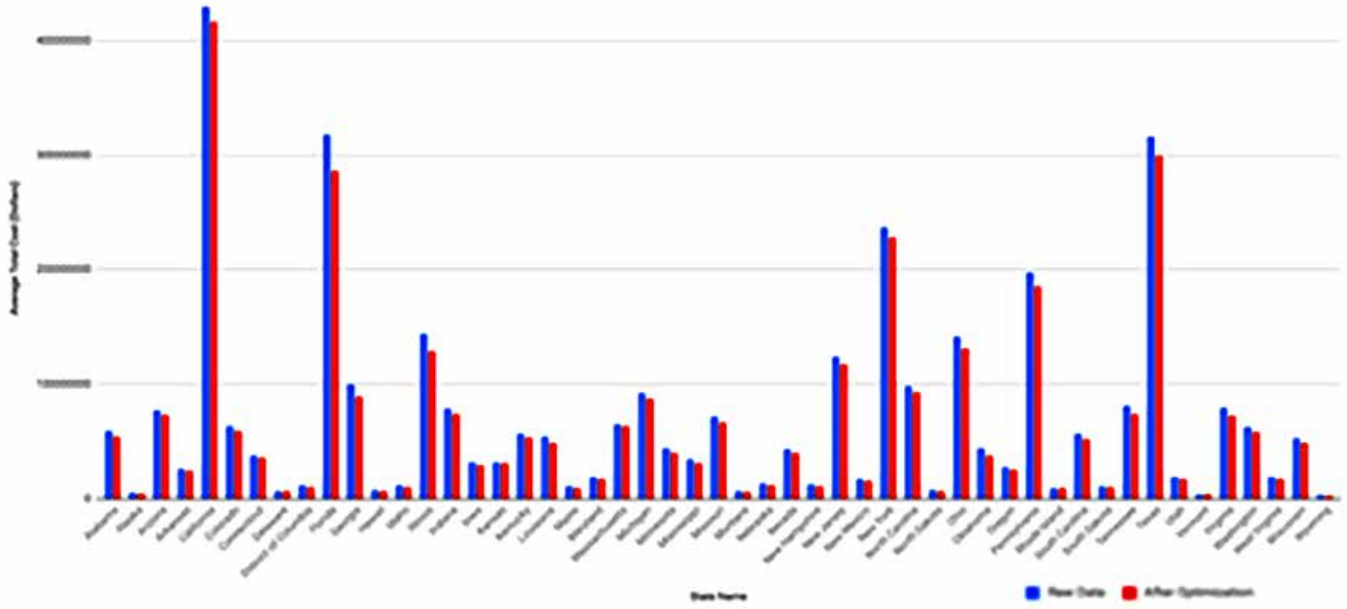

Figure 15. Comparison Chart for Average Total Cost for the Operation of Hospital Beds in Each State Before and After Optimization [3]

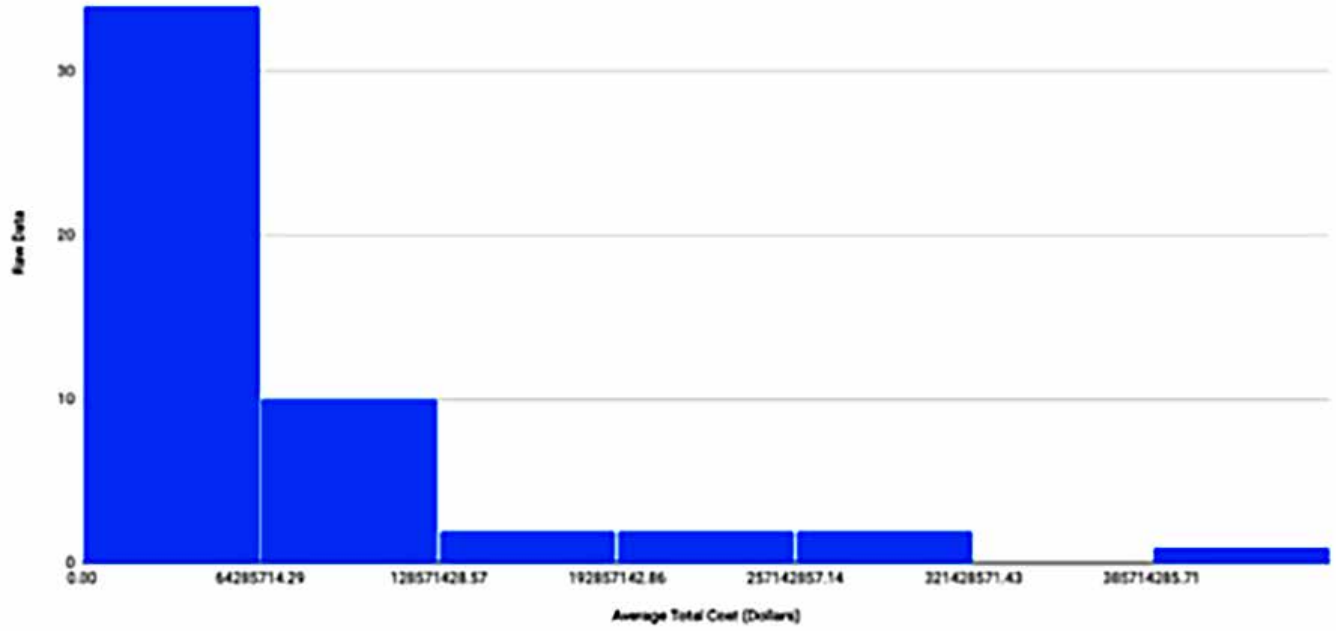

Figure 16. Histogram Charts for the Average Total Cost of Operation (Dollars) for the Operation of Hospital Beds for All the States in the USA Before the Optimization [3]

The network flow model suggests that the average total cost of running hospital beds can be reduced up to 5% in those more developed areas/states while the reduction is even higher, hitting 15% in some less developed areas/states, once the hospitals get rid of redundancies. Through the effects of expansionary fiscal policies and monetary policies conducted by both the federal government and the Fed (central bank), we will be able to make available more funds that can be allocated to the medical sector, and, in the meantime, reducing the average total cost that places a huge burden on certain hospitals.

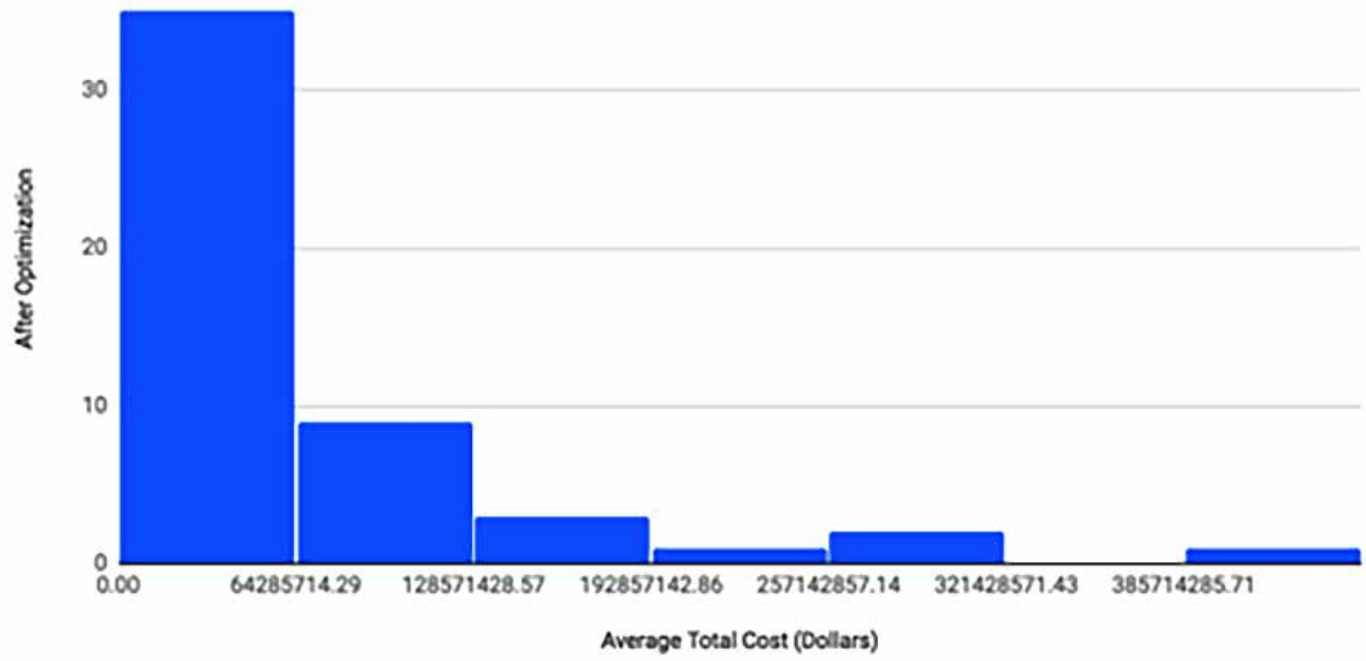

Figure 17. Histogram Charts for the Average Total Cost of Operation (Dollars) for the Operation of Hospital Beds for All the States in the USA After the Optimization [3]

A higher GINI coefficient will result in a more unstable Lorenz Curve. Through further research presented in this report, we find out that a higher GINI Index also means a wider Poisson Distribution, higher bed/inpatient days, patient arrival rate, bed occupancy rates, emergency room wait time, bed turnover ratio, etc, with fewer beds per capita actually available for citizens of the state.

Conclusion

In this study, the relationship between the current increasing trend for the demand of hospital beds and the increasing cost of healthcare services and the aging of the population is evaluated, which will help the hospitals need to integrate resource management and hospital bed allocation. Gini coefficients and Lorenz Curve are used to predict the aging of the population, which helps to build up the supply and demand curve of the hospital beds in the long run. The Erlang Loss Formula is used to analyze the patient flow in the hospitals of the region with the different situations of the area and the need for medical care. The Logistic model is used to predict the future outcome of the allocation of hospital beds. In the next step, the optimization model is proceeded to get the optimal arrangement of hospital bed allocation. The Network Flow model is used in the evaluation to minimize the average total cost of operating hospital beds.

Based on the modeling result, it can be seen that the current hospital bed management system is, to some extent, somewhat efficient. However, this only applies to those states where the GDP is comparatively high and the GINI Coefficient/Lorenz Curve is low and stable. In the states where there is a large gap between the rich and the poor like the District of Columbia, the current system that is running in the medical section of the government isn't at its optimum capacity. The network flow model suggests that the average total cost of running hospital beds can be reduced up to 5% in those more developed areas/states while the reduction is even higher, hitting 15% in some less developed areas/states, once the hospitals get rid of redundancies. Through the effects of expansionary fiscal policies and monetary policies conducted by both the federal government and the Fed (central bank), we will be able to make available more funds that can be allocated to

the medical sector, and, in the meantime, reducing the average total cost that places a huge burden on certain hospitals. A higher GINI coefficient will result in a more unstable Lorenz Curve. Through further research presented in this report, we find out that a higher GINI Index also means a wider Poisson Distribution, higher bed/inpatient days, patient arrival rate, bed occupancy rates, emergency room wait time, bed turnover ratio, etc, with fewer beds per capita actually available for citizens of the state.

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Section 4. Economics, organization and management of enterprises, branches, complexes

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AUTOMATION PROBLEMS OF THE INTERNATIONAL CONTAINER SHIPPING PROCESS AND THE ECONOMIC EFFECT OF USING THE RATEREQUEST.RU PLATFORM TOOLS

Abstract. The transition to a digital economy in the field of organizing international container shipping is now entering an active phase. Considering that already now, there are quite formalized concepts in the field of international tourism (booking.com; agoda.com, etc.), passenger flights (scyscanner.com) and auto (uber.com) transportation with stable and clear monetization models for all market participants, most modern projects in the field of international container shipping are trying to repeat their success. The RatereQuaest.ru website is a service-tariff aggregator, a marketplace of various transport companies' tariff information. This article analyzes how operational efficiency changes using raterequest.ru, the capabilities and advantages of the electronic platform RATEREQUEST.RU are observed for both – companies using the services of international container shipping and freight forwarders involved in organizing international shipping.

Keywords: raterequest.ru, marketplace, international container shipping, platform for transport automation.

1. Introduction

In the era of rapidly developing modern information technologies, the main direction of the logistics services development is customer focus: processing applications in the shortest possible time, increasing the level of service. Due to the fact that the market of goods and services is very saturated and crowded, share of e-commerce sales will reach 17.5 percent of retail sales worldwide by 2021, and it's exponential growth and demand will undoubtedly impact the

logistics and transportation industry [1], special attention is paid to the formation of various technologies in order to increase competitiveness, achieve and maintain a leading position in the modern market. The largest container carriers' desire to reduce the reduced cost of transporting one container by increasing the tonnage has led to a situation in which the market for transport services in the field of international container shipping has become characterized as a market with a significantly prevailing supply. Meanwhile it is expected that the huge economic impact of logistic cost on companies and of transportation on the environment, together with new arising business opportunities, will rapidly change transportation and logistics [2]. This circumstance significantly aggravates the competitive situation in the described market. The desire to reduce costs by reducing the costs of all resources (primarily time) is one of the driving factors in the transition to a digital economy.

Modern web platforms offering services of choosing the best logistics option have large data bases of freight forwarders where information is provided for mass use. Also, such services have an expanded functionality of capabilities that provide parallel simultaneous processing of databases with a diverse data structure, multi-object documents, the creation of local, multi-functional problem-oriented information systems for various purposes based on high-speed personal computers and local area networks.

Transport is one of the main sectors of the national economy. The effectiveness of the Russian transport complex is becoming an indispensable condition for its balanced development and systematic integration into the global transportation system. It is the transport function that becomes a strategic resource of the national economy of the Russian Federation, since it ensures the accuracy of deliveries for leading industries and the development of trade [3]. At the present time, foreign economic activity is intensifying, the total number of cross-border operations is increasing year by year (trade, production, etc.) Accordingly, the role of the transport industry in the global economy is predictably growing [4]. Currently there is a tendency to change the structure of used transport facilities – the share of container traffic is increasing, and this trend has been growing from year to year over the past 4–5 years. The competitiveness of container shipping on international routes has increased markedly over time [5]. International container shipping, unlike related areas of transport services, such as groupage cargo transportation, road transport or passenger transportation, remains one of the most poorly formalized and least automated areas of the transport industry.

The transition to a digital economy in the field of international container shipping is currently in the active phase. Given that right now, there are fairly formalized relation systems using the resources of the international information network the Internet in related sectors of the national economy, information technologies are the main source of increasing the management decisions' efficiency, productivity and competitiveness of the transport company.

2. Advantages and disadvantages of existing logistics platforms

By conducting an analysis of the current state of all well-known innovative projects in the field of logistics, we can identify two main areas of their development:

1. Services aggregation model of different performers on a single platform

1.1 Service – tariff aggregator – in the general plan it is a marketplace of various transport companies' tariff information. In most cases, the service acts solely as a platform that provides access to persons interested in shipping to information about the cost. In this case, the carrier under the contract (forwarder) is the person who has directly placed their own tariff.

The main advantage of this model is that all interested parties, in response to their request, can receive a certain set (with a certain assumption) that can be called the set of all possible options offered by different participants in the freight forwarding services market. At the same time, the platform it-

self determines the manner in which heterogeneous tariff information is brought to a single denominator, to ensure the possibility of objective comparison.

In the field of international container shipping, the best-known example is the freightos.com website.

The main drawback of this approach is that due to the fact that international container shipping is characterized by many properties and many performers participate in the organization process (including those operating in different countries of the world), therefore on the one hand, it is necessary to introduce to all the system's participants understandable rules for bringing the through rate for the carriage of goods to a unified calculation system while expanding or limiting the forwarder's liability period (set of expenses included in the through rate) to enable objective comparison of tariffs placed in the system. On the other hand, the platform should provide its participants (transport companies selling their services) with conditions for making and maintaining their tariffs up to date.

Both of these tasks are to some extent mutually exclusive. This is due to the fact that simplification of the data entry procedure has a direct impact on the quality of the tariff information received as a result of it being processed. In addition, it is important to understand that the data structure of any shipping tariff never contains enough information to automate it, and any system needs to supplement these data, adapting to their changing structure.

Below is a fragment of the MCC DROP OFF tariff that is publicly available on the Maersk official website.

Table 1.– MCC DROP OFF tariff that is publicly available on the Maersk official website

Destination	Time for delivery	20'DC	40'DC	40'HC
Moscow	35	$50	$20	$20

Table 2.– Result of formalization of the MCC DROP OFF tariff in the Raterequest.ru system.

Carrier	Transport parameter	Container type	Originating location	Destination location	Free of charge time period	Glossary	currency	price	VAT rate
MCC	DROP OFF	20'DC	Vladivostok	Moscow	35	Return empty conteiner	USD	250	No tax
MCC	DROP OFF	40'DC	Vladivostok	Moscow	35	Return empty conteiner	USD	250	No tax
MCC	DROP OFF	40'HC	Vladivostok	Moscow	35	Return empty conteiner	USD	100	No tax
MCC	DROP OFF	20'DC	Vladivostok	Moscow	35	Return empty conteiner	USD	250	No tax
MCC	DROP OFF	40'DC	Vladivostok	Moscow	35	Return empty conteiner	USD	250	No tax
MCC	DROP OFF	40'HC	Vladivostok	Moscow	35	Return empty conteiner	USD	100	No tax

From the example we can see how one line of the tariff was transformed into 6 lines of a formalized presentation form and new columns appeared with data that are either absent in the original source or entered into the narrative of the context.

The search for a compromise in most cases comes down to the fact that the platforms implement their service within the framework of the described model.

– either the platforms offer a service for all participants, while the data entry is reduced to the entry of previously prepared rates in the forms provided by the system. (At the same time, the quality of calculating the transportation cost suffers, and the core of the platform shifts towards the development of the social aspect of interaction between the participants in the system.) – for example, the JCTRANS platform (China), Bookcargo.com (Singapore)

– Or vice versa, the introduction of tariffs turns into an overly formalized process, requiring the participant to divert serious resources. For example – Cargosphere.com

3. Introduction of the RateRequest system

The RateRequest.ru shipping tariffs automation platform is a software package for managing shipping tariffs for multimodal transportation of containerized goods. RateRequest (hereinafter RR) is a tool for organizing multimodal container transportation and can be used as a management decision support system. The regularly updated database contains information on many routes and services of leading transport companies. The client will be able to independently objectively evaluate market information and choose the best option for the carriage of goods, taking into account individual criteria.

Combinations of acceptable ways of organizing shipping for different types of containers and loading options, with the participation of various container lines, carriers, ports and terminals, form a set that represents the original matrix of options for transport and logistics delivery schemes in the RR system. For each option, the complex cost of shipping is calculated, taking into account the services' tariffing peculiarities of each participant, and also an element-by-element description of all stages of shipping is formed.

To obtain the information on the options of transport and logistics schemes for the delivery of goods, the RR user only needs to indicate the points of shipment and destination. This enables effective interaction between suppliers and consumers of transport services thereby increasing the efficiency of management decisions.

The main distinguishing feature of the described platform is the ability to present all possible options for organizing international container shipping in a convenient comparative form. In addition, the algorithm used by the system allows to generate the exact cost of transportation within a given route for each method of its organization. By the methods of organizing transportation within the framework of the described system, we mean the complex of operations, as well as the combination of related modes of transport, in result of interaction with which a specific transportation problem is solved [6]. The platform consists of a public part accessible to all users and an internal part – available only to registered forwarders.

4. The business process description of the sale of transport services in terms of the interaction of the system and users

The system of relations between the sales department of the transport company and the customer is considered as an algorithm for the sale of transport services in the form of a set of simple actions performed by employees of the transport company's sales department.

Step 1. Database formation.

At this step, the employee needs to create a record in the database, indicating the name of the counterparty and general information about him, and add the contacts of decision makers. The type and intensity of next step's interactions depend on what stage the counterparty is at, and what history of relations they have, if any, and its general usefulness as a client (degree of client potential for the company).

Step 2. Regular offer of own services.

This step is possible provided successful contact is established, and if the client is interested in the company's services. A sales employee makes phone calls, sends commercial offers, quotes bids. The main objective of this step is to receive constant requests from the client interested in the company's services, so that when deciding on the choice of a contractor, the client perceives the company's offer as one of the alternatives considered by him.

Step 3. Receiving the first order from the customer.

This step is the target event, because when it occurs, the client, from a potential one, turns into a developing client. At this stage, the sales department employee, depending on the management structure of the transport company, must either independently control interactions with the client and compliance with the stage-by-stage processing of his first order, or ensure strict compliance by actual executors with the terms of the proposal accepted by the client and its exact implementation in accordance with customer requirements, dynamically changing the criteria for evaluating the effectiveness of performance depending on the dynamics of changes in the vector of its own priorities.

Step 4. Receiving regular orders from the client.

If the client is satisfied with the results of the previous step, then upon the occurrence of this target event, the client from a developing one, changes its status to developed. The goal of the communication actions taken at this stage is to keep the client in the current stage for as long as possible.

All other steps of this algorithm can be considered as intermediate deviations, and target actions performed upon the occurrence of each of these events are aimed at returning relations with the client to the main line of this sequence.

5. Problems of sales process automation, a brief description

If we formulate the events of the sales department work algorithm described above in the form of the sum of the time resources consumed at each step and adjust the data depending on the degree of involvement of the sales staff, then the largest share will be at the stage of interaction with the client at the phase of quoting and presenting quotation results in the form of a unified commercial offer.

On the one hand, the probability of its acceptance depends on how accurate, complete, reliable, relevant, and correctly performed the calculation of the transportation cost was on the route required by the client, on the other hand, given that when making a choice, the client evaluates the offer in accordance with other criteria (including those reflecting his subjective attitude to the company), it is necessary to allocate available resources in such a way to solve this problem as efficiently as possible.

A deeper analysis of the causal relationship of the decision to choose the best option allows us to conclude that the speed of response, the degree to which the result is drawn up, the relevance of the price information provided (provided that the company's offer is objective in the market), is also a factor forming a positive image of the company.

Thus, solving the problem of automating the process of selling shipping services, in our opinion, it is necessary to concentrate primarily on reducing the resources spent on quotation of transportation rates, while improving the quality and degree of the price proposal completeness sent to the client.

The development of the mechanism of organizational and economic support for the functioning of the logistics system of transportation management, based on the use of program-targeted and structural-functional methods, involves the development of a set of sequential actions and the determination of the means of the mechanism on the functioning of the logistics management system. This will ensure the improvement of the quality of logistics services in accordance with corporate standards of logistics services [7].

6. Advantages and Economic Benefits from using the RR platform tools in the daily practice of a transport company's sales department

The use of computer technology and modern software allows you to significantly increase speed of adoption and improve the quality of management decisions. The current state of logistics and its development is largely formed due to rapid development and implementation in all areas of information technology business.

Thus, taking into account what has been said above, we can estimate that it takes a significant amount of time to create a fully individual commercial offer based on the available information about the cargo and the transportation route that may be of interest to a particular client. Our research shows that, on average, a sales manager spends about 40 minutes on completing a new business proposal.

At the same time, using the RR service, the same process will take no more than 10 minutes, while the offer for the client will be completely individual, an email will be generated for the client according to a pre-configured template and the commercial proposal will be generated as a file with a unique number, so the transport company's employee will be given the opportunity to control the letter's receipt, and thus carry out a preliminary segmentation of the customer's interest, expressed in the amount of times the letter was opened.

We consider the economic effect as the difference between the employee's time spent interacting with the client without using platform tools and the same time spent using the RR platform tools.

The working time fund is the volume of hours for a certain period in which the employee works. This indicator is influenced by many factors.

The working time fund is the most important indicator determining the effectiveness of employees. When calculating it, various formulas are used. The task of the employer is to use the resources with the highest productivity possible [7].

Based on the definition of the working time fund, we calculate the employee's working time fund for one working day:

$$F_{working\ time\ fund} = t_{time\ of\ a\ full\ working\ day} \times k_{coefficient\ of\ labor\ productivity} \times 60;$$

$F_{working\ time\ fund}$ – fund of the employee's working time for one working day, min.

$t_{time\ of\ full\ working\ day}$ – time of a full working day, hour (8 – hour working day)

$k_{coefficient\ of\ labor\ productivity}$ – the coefficient of labor productivity, (0.9–0.95)

The coefficient of labor productivity is the ratio of labor actually spent on manufacturing products to the labor required for its production, expressed as a percentage.

Define the fund of working time:

$$F_{working\ time\ fund} = 8 \times 0.95 \times 60_{\min} = 456_{\min};$$

Labor productivity is an indicator characterizing labor productivity. Under the result of the employee's work, we take the number of prepared commercial projects during the working day.

Based on the study, the time to prepare one commercial project without the use of automation tools and instruments is 40 minutes. Therefore, within one working day, the employee can prepare the following number of commercial projects, calculated by the formula:

$$N_{(commercial\ projects)} = \frac{F_{working\ time\ fund}}{t_{(commercial\ projects)}};$$

$N_{(commercial\ projects)}$ – the number of commercial projects prepared by one employee during the working day

$t_{(commercial\ projects)}$ – the time to prepare one commercial project without the use of automation tools and instruments = 40 min

$$N_{(commercial\ projects)} = \frac{456}{40} - 11.4;$$

The number of commercial projects is rounded down to an integer.

$$N_{(commercial\ projects)} = 11 commercial\ projects$$

The number of prepared commercial projects reflects the productivity of one employee within one working day.

When using tools and automation tools for the RR platform, the preparation time for the control gear is reduced to 10 minutes.

We calculate employee productivity when using the RR platform:

$t_{(commercial\ projects\ RR)}$ – the time to prepare one commercial project with the use of automation tools and instruments = 10 min

$$N_{(commercial\ projects\ RR)} = \frac{456}{10} = 45.6;$$

The amount of commercial projects is rounded down to an integer.

$$N_{(commercial\ projects)} = 45\ commercial\ projects$$

We calculate the growth of employee productivity in one working day:

$$R^n = \left(\frac{N_{(commercial\ projectsRR)} - N_{(commercial\ projects)}}{N_{(commercial\ projects)}} \right) \times 100\%;$$

$$R^n = \left(\frac{45-11}{11} \right) \times 100\% = 309\%;$$

Conclusion:

Based on the foregoing, as a justification for the effectiveness of using the tools of the Raterequest.ru platform in the everyday practice of the sales department of any transport company, we can talk about a linear relationship between the growth of labor productivity and the increase in the number of customers.

The economic effect of using RR is expressed in an increase in employee productivity per employee by 309% in one working day compared to employee work in one working day without the use of automation.

In addition to the increase in labor productivity described above, it is also possible to single out an increase in the efficiency of the sales department due to:

- Improving the quality of service due to an individualized approach;
- Unified form of information provision;
- Convenience and speed of interaction;
- Wide coverage of market participants providing shipping services;
- Improving the efficiency of the company by ranking customers according to their importance.

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ENSURING INNOVATIVE DEVELOPMENT OF AGRICULTURE OF KAZAKHSTAN: PROBLEMS AND WAYS OF SOLUTION

Abstract. The article reveals the main problems of ensuring innovative development of the agro-industrial complex (AIC) of Kazakhstan. Shows the risks, the analysis of the main challenges faced by agriculture, explored possible solutions and improvement of innovative development of agroindustrial complex of the country.

Keywords: Kazakhstan, agro-industrial complex (AIC), innovations, innovative development, technologies.

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ОБЕСПЕЧЕНИЕ ИННОВАЦИОННОГО РАЗВИТИЯ АПК КАЗАХСТАНА: ПРОБЛЕМЫ И ПУТИ РЕШЕНИЯ

Аннотация. В статье раскрываются основные проблемы обеспечения инновационного развития агропромышленного комплекса (АПК) Казахстана. Показаны риски, проведен анализ основных нерешенных проблем, с которыми сталкивается АПК, изучены возможные пути решения и совершенствования инновационного развития агропромышленного комплекса страны.

Ключевые слова: Казахстан, Агропромышленный комплекс (АПК), инновации, инновационное развитие, технологии.

В экономическом словаре дается следующее толкование «Агропромышленный комплекс (АПК) – это крупнейший межотраслевой комплекс, объединяющий несколько отраслей экономики, направленных на производство и переработку сельскохозяйственного сырья и получения из него продукции, доводимой до конечного потребителя» [1].

Инновационное развитие АПК Казахстана предполагает эффективное применение научно-технического потенциала, интеграцию науки, вузов, НИИ и производства, другими словами, на основе инновационных технологий технологическую модернизацию экономики. Осуществление поставленной задачи требует соответствующих условий: совокупности законодательных, материальных, технических и иных средств, обеспечивающих финансовое, маркетинговое, информационное, экспертное, кадровое и другое обслуживание.

Наличие разных климатических зон и уникальное географическое расположение создают благоприятные условия для всестороннего развития АПК в Казахстане, а его успешное инновационное расширение приводит к достижению следующих взаимосвязанных целей: рациональному использованию ресурсов, экологическому и социальному благополучию и обеспечению продовольственной безопасности страны.

Анализ социально-экономической ситуации Казахстана в АПК свидетельствует, о наличии ряда нерешенных проблем для инновационного развития: применение устаревших технологий, слабую интенсивность процесса внедрения и освоения новых технологий и техники сельскохозяйственного производства, несовершенные методы и формы организации производства и управления, слабую конкурентоспособность отечественной селекции растениеводства на внешних рынках, проблемы доступа к водным ресурсам.

Важной проблемой остается борьба с вредителями и болезнями, которая осложняется нехваткой специализированной техники и дефицитом агрономических знаний у сельхозпроизводителей. Вместе с тем, следует отметить также слабую логистику в АПК (транспортировку и хранение как полуфабрикатов, так и готовой продукции).

К другим, не менее важным факторам, которые сдерживают инновационное процветание агропромышленного комплекса можно отнести недостаток оборотных средств, высокие риски, присущие сельскохозяйственному производству, низкий уровень привлечения инвестиций в АПК.

Высокие риски связаны в первую очередь с риском финансирования научно-производственных результатов, так как не всегда можно получить положительные результаты из-за погодных условий, из-за качества почв, нерационального использования удобрений и т.д. Другим видом риска является риск временного разрыва между произведенными затратами и полученными результатами. Также существует риск из-за неопределенности спроса на выпускаемую инновационную продукцию, что связано с конкурентоспособностью, в свою очередь, неопределенность спроса на инновационную продукцию не вызывает желания у частных инвесторов вкладывать капитал в развитие сельского хозяйства.

Низкая платежеспособность сельскохозяйственных производителей, рутина, а также низкая информированность сельчан приводят к проблемам [2].

Все это приводит к понижению инновационной активности отраслей АПК, к росту себестоимости и низкой конкурентоспособности продукции, а также задержке социально-экономического развития сельского хозяйства и качества жизни на селе.

На наш взгляд, для инновационного развития АПК необходимы следующие мероприятия:

– в области обеспечения ресурсами: содействие государственно-частному партнерству (ГЧП), применение консалтинга для сельскохозяйственных товаропроизводителей, и содействие выведению новых сортов и гибридов, создание банка данных для элитно-семеноводческих хозяйств.

– в области науки и производства: создание совместных исследовательских проектов в вопросах развития отраслей сельского хозяйства, развитие длительных отношений сельскохозяйственных производителей с перерабатывающими организациями, развитие технопарков и кластеров для увеличения объемов производства и рентабельности, создание новых рабочих мест, увеличение объема бюджетных поступлений и экологической обстановки.

– в области инноваций, трансферта и цифровизации: расширение возможностей кредитования и создание единого банка данных по инновациям и новым технологиям в сельскохозяйственном производстве, цифровизация, разработка и внедрение ноу-хау в области выращивания и производства растениеводства и животноводства, дифференциации агротехнологий в соответствии со спецификой сельскохозяйственных зон и территорий, использование биотехнологий защиты растений и почвы [3, С. 153].

– в области экспортного потенциала: развитие логистических и инфраструктурных проектов, а также строительство современных экспортных терминалов [4, С. 54].

Решение данных проблем позволит обеспечить инновационное развитие АПК, снизить зависимость от импорта сельскохозяйственной продукции, а также способствовать росту продовольственной безопасности страны. Вместе с тем, интерес к АПК со стороны зарубежных потребителей возрастает, что должно мобилизовать казахстанских аграриев.

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ANALYSIS OF GAZPROM INTERNATIONAL INVESTMENT PROJECTS

Abstract. Developing export activities in various directions, Europe remains the main direction for PJSC Gazprom (Russia). Gazprom investment projects are internationally efficient.

Keywords: investment project, Gazprom, gas pipeline, analysis, export, Europe, price, deliveries.

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АНАЛИЗ МЕЖДУНАРОДНЫХ ИНВЕСТИЦИОННЫХ ПРОЕКТОВ ГАЗПРОМ

Аннотация. Развивая деятельность экспорта в различных направлениях, главным направлением для ПАО «Газпром» (Россия) остается Европа. Инвестиционные проекты Газпром отличаются международной эффективностью.

Ключевые слова: инвестиционный проект, Газпром, газопровод, анализ, экспорт, Европа, цена, поставки.

Развивая деятельность экспорта в различных направлениях, главным направлением для ПАО «Газпром» (Россия) остается Европа. Формирование проевропейской экономической и социальной политики России началось в 1990 гг. С приходом в ЕС бывших стран СССР, отношения у России с ним осложнились. Поэтому Россия попыталась сблизиться с Францией, Испанией, Великобританией, Италией и Германией для нормализации отношений.

В 2000 г Россия приступает к диалогу с Европой. Увеличение потребления газа России гарантирует то, что большинство стран хотят отказаться от атомных станций. И после действий в сентябре 2001г, которые подорвали репутацию Ближнего Востока как ответственного поставщика газа, Россия становится для Европы энергетическим гарантом. Тут «Газпром» реализует газопроводные проекты, которые и связывают Россию с Европой.

В 2006г, из-за газового конфликта с Украиной, дружественные, на первый взгляд, отношения, приобретают нежелательный характер в отношении с Европейским союзом. Газопровод проходит через Украину, через него экспортируется 90% газа из России, поэтому расхождения в цене с Украиной вызвали сбой поставок газа в Европу. Политика воздействия, по итогу, может быть восстановительной – понижение цены на газ, и разрушительной – увеличение цены, постройка газовых путей.

По причине конфликта с Белоруссией в 2007 г, когда закрыли нефтепровод «Дружба», инцидент со сбоем поставки энергоресурсов повторился. Чтобы завершить газовый конфликт, правительство России решило поставлять газ в Минск по заниженной цене.

Рассмотрим инвестиционную деятельность «Газпрома» в международном направлении. К основным из них относятся: страны СНГ, страны Азиатско-Тихоокеанского региона, европейское пространство, Африка, Латинская Америка. Проекты, которые имеют немаловажное значение для внешней политики России: Северный поток, Южный поток, Голубой поток, Сила Сибири, Сила Сибири – 2. Европейские страны остаются основным экспортным рынком [1, 49]. Проект «Северный поток» – газопровод, который экспортирует газ России в Европу. Он был создан для наполнения рынка Европы природным газом. «Северный поток» связал крупные запасы газа России с европейской транспортной системой, исключая Польшу, Украину, Белоруссию, это страны транзиты. Проектная мощность «Северного потока» – 55 млрд. куб.м газа. А пропускная способность газопроводов, которые проходят не на территории Украины – 176 млрд. куб.м газа за год. Так как при поставке газа России таким маршрутом исключаются транзитные страны, это развивает отношения России и Европы. Относительно социально-экономической позиции, роль данного проекта состоит в приобретении прибыли от эксплуатации газопровода и население некоторых стран Европы получат газ в запрошенном объеме. Строительство газопровода помогло обновить газотранспортные линии, ещё, советских времён. А также способствовало росту инфраструктуры внутри России.

При создании проекта «Северный поток», сначала было решено создать управляющую компанию «Nord Stream AG». Продвижению интересов России, при эксплуатации проекта, способствовало следующее решение – привлечение к работе в «Nord Stream AG» бывшего канцлера Германии Герхарда Шрёдера и Маттиас Варнига. Созданная компания укрепила долгосрочное партнерство между Россией и Германией и содействовала развитию национальных интересов России в Европе. Проект «Северный поток» был осуществлён успешно, что привело к решению построить газопровод «Северный поток – 2». Такой проект, будет поставлять газ из России в Европу. Падение добычи газа в Европе повысило спрос на импорт газа. Их проектная мощность в сумме – 110 млрд. куб. м газа в год.

В странах ЕС, за последнее время, возрос спрос на газ из России на 1/3. Но, с 2016 года поставки «Газпром» в государства дальнего зарубежья возросли практически на 30%, по сравнению с таким же отрезком 2015 года – до 7,8 млрд. куб. м. Понизилась добыча газа в Европе. Это привело к росту поставок газа из России, что доказывает актуальность постройки «Северный поток-2» через Балтийское море в Европу.

ПАО «Газпром», которое занимает 1 место, реализовал проект «Голубой поток», который является очень важным для Турции. Минуя третьи страны, это сооружение проходит из России в Турцию через Чёрное море. «Голубой поток» [2] занимает больше 1000 км и около 60 км газопровода проходит по возвышенностям, а в море его глубина достигает 2150 м. При его постройке использовались новейшие технические разработ-

ки. Высококачественные стойкие трубы, с полимерным покрытием внутри и снаружи, усилили надёжность газопровода. При создании сооружения был задействован нефтегазовый концерн из Италии, он имел нужный опыт и технологии. После того как проект был запущен, Турция согласилась на долгосрочные отношения, получив 65% газа России от числа всех поставок [3, 102].

ПАО «Газпром» в поисках путей выхода во взаимоотношениях со странами Латинской Америки, это можно понять исследуя проекты компании в Венесуэле и Боливии. Доступ к ценным природным ресурсам континента Латинской Америки приведёт к изменениям в мировом балансе на энергетическом рынке. Так как обладатели энергетических ресурсов технологически плохо развиты. Стратегическим значением для Европы обладают поставки углеводородов из Африки.

В 2014г «Газпром» с Китайской национальной нефтегазовой корпорацией подписал Договор купли-продажи газа России по «восточному» маршруту. Данный договор позволяет поставлять в Китай 38 млрд. куб.м газа в год. Его срок составляет 30 лет. «Сила Сибири» будет доставлять газ российским потребителям на Дальнем Востоке и в Китай из Иркутского и Якутского центров газодобычи. А в 2015 г «Газпром» подписал соглашение на осуществление проекта «Сила Сибири – 2» с КНР. Китаю интересен запуск первой ветки «Силы Сибири-2», проектная мощность которого составляет 30 млрд. куб. м газа в год. Плюс такого газопровода состоит в прохождении через западную границу и там добывают газ, уже, с работающих месторождений. Для поставки в Китай 180 млрд. куб. м нужно построить газопровод. Но, китайцы хотят покупать газ по низким ценам, в этом и заключается главная проблема в договоре с ним. «Западный маршрут» выходит в район, там не развита промышленность, а следовательно газопровод стоит тянуть в глубь страны. Таким образом, экономической выгоды от этого проекта нет. И поэтому, китайцам на западной границе необходим газ, по самой низкой стоимости. Если не обращать внимание на суммы, то российский газ выгоден КНР в любом случае, поскольку доставка не зависит от природных условий, и он поступает без посредников. Данный газопровод будет проходить через автономный район КНР и месторождения Западной Сибири. Газ дойдет до Шанхая, после того как соединится с китайским газопроводом. 10 лет длилось подписание контракта на поставку газа в Китай. В Китай газ поступает из Туркмении и Мьянмы, поэтому Пекин отстаивал выгодные для него условия. Также у Китая существуют и другие варианты от Казахстана и Узбекистана. Однако, такой газ поступает в западные части Китая, а промышленность находится в восточной и именно с востока предлагается поставка газа России.

К 2020 году потребление газа 300 млрд. куб. м [4], а к 2040 составит 746 млрд. куб.м. Так как у КНР потребность в энергоресурсах повышается. Экспортные проекты с Китаем помогают снизить транспортные затраты на газ. При реализации проекта «Сила Сибири» в Байкальском регионе, возможна его экономичная газификация с потребительским объемом около 11 млрд. куб. м. Что будет помощью при реализации программы по газификации восточных районов России. Для поставки газа в Китай, газопровод «Сахалин-Хабаровск-Владивосток» с ответвлением в Приморском крае загрузит на всю мощность действующую газотранспортную систему. И транспортные затраты на газ снизятся. Со стороны Китая «восточные» маршруты поставки газа из России являются наиважнейшими. Поскольку основная масса потребителей сосредоточена в восточной части страны.

Проведенный анализ международных инвестиционных проектов позволяет убедиться в надежности и эффективности экономической политики российского Газпрома [5].

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WAYS OF ACTIVATE AGRICULTURE

Abstract. The article discusses how innovative development can fundamentally change in agriculture as a solution to exist problems in agriculture, as well as move to a new stage in the development of agriculture and its infrastructure.

Keywords: innovation, food security, system integration, agricultural infrastructure, innovative development, innovative model.

Introduction. In the context of global integration, ensuring food security of the country requires the sector's adaptation to the changing environment, its impact on various innovations and scientific and technological development based on sustainable agricultural development. In many developed countries, the modern stage of agricultural development is the transition to an innovative model that provides a systematic integration of the agrarian and scientific-technical sectors to increase its effectiveness. In particular, "there is an urgent need to create "smart agriculture" to optimize production and distribution systems and to introduce new business models that will enable the efficient use of land, energy and other natural resources, while focusing on the needs of the world's poor" [1].

By 2050, world population will reach 9.7 billion The global human population represents a global problem. These problems pose a serious threat to the right to adequate nutrition and the basic right of everyone to be free from hunger. Feeding the growing population and achieving the goals of sustainable development requires agricultural producers to produce more food. In this regard, innovation is about reforming the food system, saving family farmers from poverty, food security, sustainable agriculture, and the "Changing the World: September 25, 2015," adopted by the United Nations General Assembly. Sustainable Development Goals 2030". Decree "On Approval of the Innovation Development Strategy of the Republic of Uzbekistan for 2019–2021", dated May 7, 2018, PK-3698 No. 2460 "On Measures for Further Reform and Development of Agriculture in 2016–2020", as of May 29, 2018, No. PK-3751 "Mechanization and Service Providers for Agricultural Products" This research will serve to some extent in fulfilling the objectives set out in the Decree "On Additional Measures for Improving Dental Efficiency" as well as other regulations related to this activity.

Literature Review on Literature Review. "Creating Innovative Places" (NESTA is the National Endowment for Science, Technology and the Arts); Stabilizing production by introducing innovations in the agricultural sector and promoting integration between science and agricultural producers (CIRAD). Internal factors affecting the innovative potential of the European Union (ECIC), France, United States Department of Agriculture (USDA), Food and Agriculture Organization (FAO, USA) are highlighted. Support for attracting investment in infrastructure, creating and developing agrarian infrastructure in agriculture (AIJF) to help farmers increase their output and promote their products on the market (Wageningen University and Reserch Center, Netherlands, Ghent University, Belgium) – Agricultural

Infrastructure and Jobs Fund, Australia, Victoria), introduction of agricultural biotechnology (Belfer Center for Science and International Affairs, Harvard Kennedy School, Harvard University, USA), agricultural engineering improvement of his horse (MKXA named after K.A. Timiryazev – Russian State Agrarian University, Russia).

Some scientific and theoretical and organizational and economic aspects of innovative development of various sectors of the economy, including agriculture, are provided by foreign economists: D. Aschauer, R. Wethersfield, I. R. Bright, A. Stow, L. I. Abalkin, I. Ansoff, P. Baranchev, I. K. Belyaevsky, J. Bright, W. P. Krasovsky, K. R. Mackonel, L. Bru, M. Porter, Research of scientific works of IS Sandu, B. Santo, A. Smith, R. Taker, B. Twiss, R. A. Fatkhudinov, V. F. Fedorenko, M. Huchek, FK Shakirov, I. Schumpeter was made.

Some of these issues are from the economists of the Republic of Uzbekistan B. B. Berkinov, K. D. Mirzaev, Ch. Partially studied in scientific works of Choriev, R. H. Ergashev, SS Gulomov, A. M. Kodirov [2] and others.

Research Methodology. In Uzbekistan, too, much attention is paid to the provision of all the conditions for activating innovation processes in all sectors of the economy, including agriculture. Innovative development will allow solving existing problems in agriculture, as well as radically changing its appearance, and moving to a new stage in the development of agriculture and its infrastructure. In the context of modernization of the country, it is necessary to "restore the lost old varieties, rational and effective selection, wide introduction of scientific achievements and innovations in the field" [3] and "farmers who are well versed in modern technologies of production and innovation in agricultural technologies." water and air needed" [4]. At the same time, the methods and mechanisms of innovative infrastructure development must meet not only the modern market principles of the national economy, but also take into account the specifics of each region. In general, a comprehensive review of innovation activities and processes in the agricultural infrastructure sector, critical review of the practice and innovative development of the agricultural infrastructure are becoming an objective necessity.

Investment and innovative development of agriculture is a wide-ranging process, using financial resources, attracting additional sources of financing, investing in new knowledge and ideas, applying new technologies, introducing services, and introducing new forms of infrastructure management. are closely related. This problem can be solved only when investment is compatible with innovation, and balanced development of investment and innovation processes.

This approach entails studying investment and innovation as a system, and its successful development and functioning is closely linked to the infrastructure and services provided by agriculture and the level of economic growth and sustainable development.

Analysis and results. According to the analysis, the amount of innovations in the agricultural sector of Uzbekistan is 0.00004% of the gross agricultural output, and this figure is even lower in the agricultural infrastructure sector, which is 20–25 times higher than in other developed countries. Expenditures on technological, marketing and organizational innovations in agriculture increased by 354 times in 2009–2018, while the share of innovation costs in gross agricultural output declined by 8.5 times. These funds are certainly not enough for innovative development of the industry.

The analysis of expenditures on self-employed research and development activities in the field of agricultural science, by regions, showed that the largest share was in Tashkent and Samarkand regions and in Tashkent city. In 2012–2018, the costs of fundamental research in the agricultural sector in the country increased by 135.7% and applied research by 120.4%.

By the specifics of the agrarian sector, the high risk is that the funds invested in the development of innovative entrepreneurship in agriculture may not be repaid, in which case the government guaran-

tees the use of various state-guaranteed investment projects in the event of ineffectiveness of innovative projects through the development of venture funds.

The introduction of a system of venture financing for innovative activities in the field of agriculture and service infrastructure requires state regulation, namely:

– Adequate development of infrastructure facilities that ensure effective cooperation between venture companies and entrepreneurs engaged in innovative activities in the agrarian sector;

– Development of market mechanisms for investment in low-risk, high-risk projects;

– Development of economic incentive mechanisms that can attract venture capital companies to finance innovative projects in the agricultural sector;

– Ensuring the freedom of those engaged in innovative entrepreneurship in the agricultural sector;

– Provision of highly qualified specialists for venture companies engaged in agrarian sector.

Organizational-economic mechanism of innovative development of agricultural services infrastructure is a set of forms, tools and management tools that promote innovation and innovative development in this area.

According to the experience of developed countries, not only farmers and farms, but also large agroholding companies, agro-clusters and agro-technology parks, which combine the relations of the state with scientific-research and processing business in accordance with market principles, business incubators.

In the innovative development of infrastructure services in the logistics system in agriculture, it is important to consider their activities and content critically. In particular, 38% of the country's 146,295 agricultural machinery is already in service, and "16,495 units of agricultural machinery are found to be deficient" [5], requiring improvements in logistics (Figure 1).

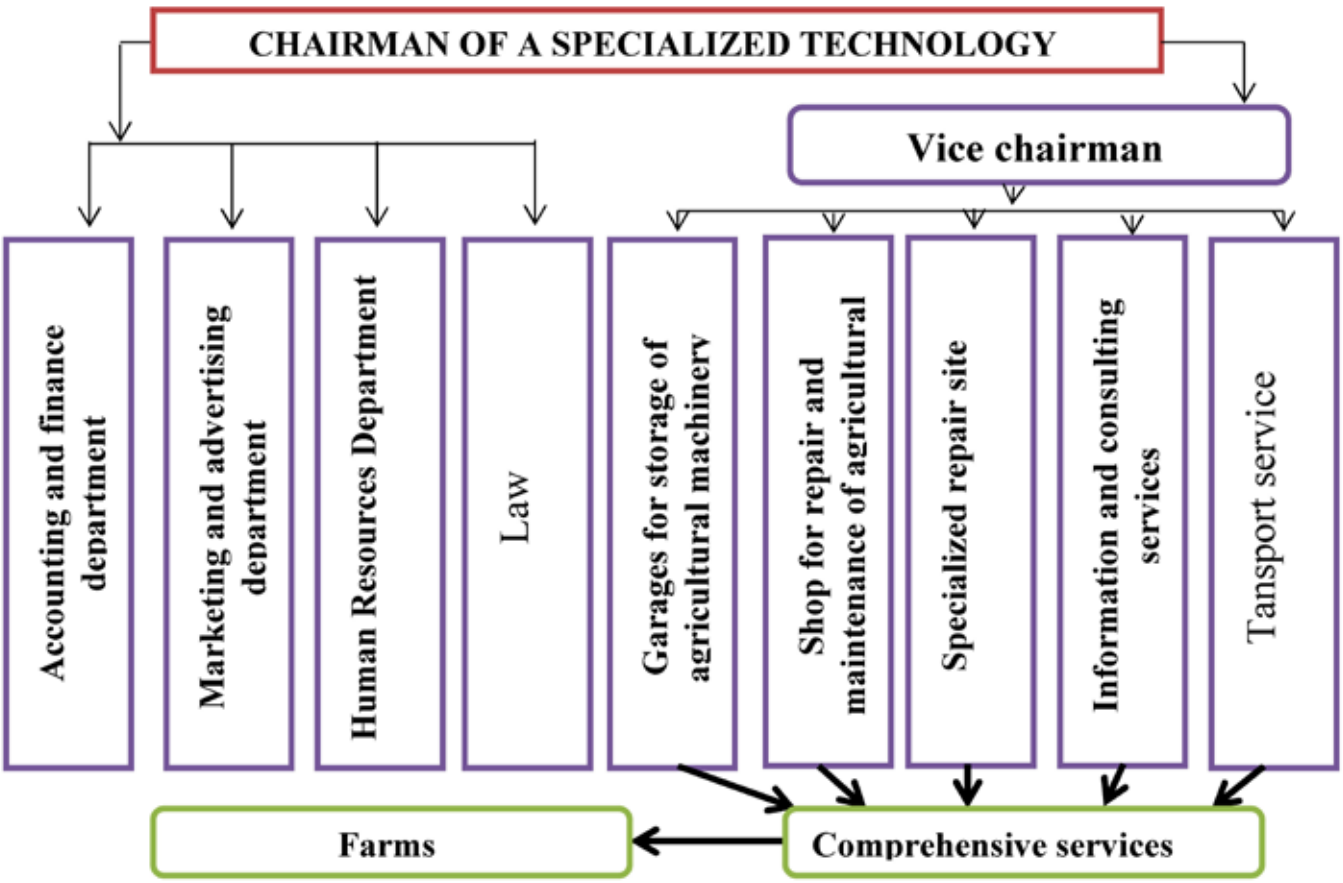

Figure 1. The proposed specialized technology center management structure [6]

It is advisable to establish technological centers specializing in innovative development of logistics system.

Specialized technology centers (based on public-private partnerships) will supply farms with the necessary agricultural machinery. It also includes departments for the repair and maintenance of agricultural machinery, special services for the introduction of advanced technologies and consulting services.

In these specialized technology centers, it is advisable to focus on creating a competitive environment between them to ensure the quality of service, ie establishing several specialized technology centers in one area.

It should be noted that Uzbekistan has all the opportunities for the innovative development of the agricultural and service infrastructure. In particular, since 2000 the average growth rate of 32 farms has been 6%.

Sustainable development and competitiveness of the industry through broad introduction of innovative technologies into production, integration of science and production, enhancing domestic and export potential of the industry, deepening production diversification for the period of 2019–2024. will be provided.

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Section 5. Economic security

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ADVANTAGES AND DISADVANTAGES OF THE DEOFFSHORIZATION POLICY IN UKRAINE IN THE CONTEXT OF THE IMPLEMENTATION OF THE BEPS PLAN AND RELEVANT INTERNATIONAL RULES

Abstract. in recent years, in Ukraine, as in many countries around the world, an active deoffshorization policy that has both a number of positive consequences and certain drawbacks was developed. The article analyses the impact of domestic and international anti-offshore policy measures on the financial security of the state of Ukraine.

Keywords: state financial security, BEPS, offshore zones, tax evasion, deoffshorization policy.

Global deoffshorization trends began as early as the 1970s, when the processes of creating offshore jurisdictions to optimize the tax burden became particularly active, reaching the entire global community. Due to the emergence of more aggressive tax burden minimization methods, the fight against the offshore jurisdictions has become particularly important, and global deoffshorization policy has been recognized as a strategic benchmark for global financial security from a sustainable development perspective.

Ukraine's experience in anti-offshore confrontation is relatively small, since the practice of capital "laundering" through its outflow to jurisdictions with favourable monetary and fiscal regimes began to emerge only from the moment when Ukraine left the Soviet economy and became an active participant in international financial markets, including offshores. The rapid offshorisation of the Ukrainian economy is conditioned by the establishment of a favourable for such processes environment. On the one hand, there is a system of a great tax pressure on business and a low level of protection of corporate resources in Ukraine. On the other hand, general political instability and harsh investment climate complicate the conditions for attracting investments and doing business, stimulating investors to seek a more favourable business environment. Moreover, with each passing year, the problem of black economy in Ukraine is getting a more negative traction, which is caused by not only domestic factors, but also the influence of global

trends in social development. First of all, total digitization of the economy and high mobility of financial resources is to be addressed. In such circumstances, the establishment of a regime promoting the artificial taxation minimization by individual states poses a serious threat to the financial security of Ukraine through reducing budget revenues and deteriorating the financial stability due to shifting a part of the capital to offshore zones.

The question of guaranteeing security at different levels of economic relations has become urgent for Ukraine: the security of business entities and the security of the state as a whole, especially its financial component. To this end, active deoffshorization policies have been deployed in recent years.

Ukraine supports initiatives of the international community regarding mutual administrative assistance in tax matters, combating corruption and terrorist financing, facilitating financial investigations, establishing transparent mechanisms in the field of tax information sharing and joint control over financial flows. In addition, tax legislation is being improved, the number of taxes, their rates and taxation schemes are being reduced. According to the criteria of estimation of the International Tax Competitiveness Index (ITCI) in Ukraine there is a *rather comfortable tax climate* with a low level of income tax (18%) and tax on dividends, interest and royalties (15%) [1], with Ukraine not included in any list of offshore jurisdictions.

In addition to the obvious progress of the Ukrainian tax reform, the question of finding mechanisms for implementing many necessary measures and initiatives in the field of countering black economy of the national economy and its off-shoring remains. The main problem is the lack of transparency in the mechanisms of *exchange of financial and tax information*. Foreign companies, moreover, controlling authorities of other states, do not have full access to Ukrainian banking and tax information. Formal accession of Ukraine to the BEPS Plan has not yet ensured a definitive transition to international inquiry-based information exchange standards (EOIR) and has not facilitated the introduction of standards for automatic exchange of information between fiscal authorities (AEOI) [2].

Similar to the EOIR/AEOI rules (FATCA) [3] were ratified by Ukraine in October 2019. The relevant bilateral agreement provides for requirements for Ukrainian financial and fiscal authorities to control accounts opened by US taxpayers in Ukraine and for relevant information automatic exchange with US fiscal authorities. Here, the main difficulties are related to the requirements for tax authorities' software and its compatibility with international databases. The questions of quality and level of information protection as important components of overall financial security also remain open.

The security aspect of de-offshore policy is addressed in studies by various international groups and organizations. Thus, according to FATF, Ukraine belongs to the group of countries with a medium level of risk for money laundering and terrorist financing (Basel AML index), listed 37 out of 125 as of the beginning of 2019 (risk level – 60.1%) [4]. In this context, a related indicator is the degree of non-compliance with the FATF standards calculated by the Council of Europe Monitoring Service (MONEYVAL). For Ukraine, this indicator is 59.6% and characterizes partial implementation of international rules [5]. At the same time, in the context of financial openness, Ukraine is considered to be a country with an average level of transparency of the financial, including tax, system: the FSI index in 2018 was 69.2% (43th out of 112 countries) [6]. The main problems of the procedure for disclosing bank secrecy and accessing information contained in the depository accounting system still remain.

The main measures of deoffshorization of the Ukrainian economy, their benefits and problematic aspects of the implementation process derived from the content analysis of the tax regulatory framework in Ukraine, international strategic and program documents, studies of national scholars and practitioners in the field of counteracting capital outflow and "erosion" of the tax base are presented in (Table 1).

Table 1.– Advantages and disadvantages of deoffshorization policy in Ukraine in the vectors of its implementation

Deoffshorization measures	**Advantages**	**Disadvantages**
1	***2***	***3***
Tax administration and optimization		
Introduction of a simplified tax system (STS) for small businesses (as it is known currently – since 2011)	Reducing the number of bureaucratic procedures by simplifying tax accounting for small businesses and sole entrepreneurs, facilitating the counter measures against their dark income	Inability of STS to act as an effective tool for counter measures against business' dark income
Implementation of the electronic administration system (EAS) for VAT (2014)	Preventing the formation of fictitious VAT	The imperfection and lack of security of databases in VAT EAS
Transfer pricing in controlled transactions (setting a «fair» price and tax obligations)		
Changes to the Tax Code of Ukraine regarding Transfer Pricing issues – TP (2013–2018)	1. Introduction of the TP institute 2. Economic effect of the growth of the state budget revenues through tax obligations adjustments	Failure of the TP to control the activity of small and medium-sized enterprises, as well as small amount transactions
Introduction of the arm's length principle as the basic standard for TCU (Law of Ukraine No. 408-VI as of 04.07.2013, Article 39 of the Tax Code)	Ability to compare transactions between interdependent entities from the standpoint of tax benefits, benefits or disadvantages they create to prevent tax evasion	1. The ambiguity and complexity of the application of the arm's length principle (subjectivity of methods). 2. Low efficiency of the taxpayers audits regarding TP issues
Deoffshorization policy planning and designing		
Signature of the Decree of the President of Ukraine No. 180 of April 26, 2016 "On measures to counteract the tax base erosion and profits shifting to abroad"	1. Approval of the concept and establishment of a special working group on the development of deoffshorisaton legislation. 2. Strengthening the regulatory environment, tax administration and financial security of the state	1. The declarative nature of some initiatives and their preservation only at the level of legal drafts 2. Non-systematic approach in the development of legal and practical measures for deoffshorization
Joining the BEPS Project (2017)	Development of an Action Plan to avoid tax base "erosion" and tax avoidance	Ukraine's unwillingness to work according to BEPS requirements (inconsistency of actions)
Ratification of the Multilateral Convention on the Implementation of Measures Concerning Taxation Agreements with a view to counteracting tax base erosion and tax avoidance (MLI) (2019)	Implementation of the BEPS "minimum standard" (actions 6, 7, 14) – the introduction of a ban on the use of a tax treaty between states in order to evade taxation or to benefit from tax exemptions by the application of a Principal Purpose Test	Difficulty in implementing the rules of the MLI Convention in the absence of appropriate regulations (provisions, instructions, rules) that will allow the implementation of MLI procedures
Exchange of information in the field of tax regulation		
The conclusion by Ukraine of 77 treaties with other countries on the avoidance of double taxation of income and property (DDT) (since 1993)	Inclusion in most treaties of the concept of "beneficial owner" whereby, when paying in favour of a non-resident, income originating in another country, it is permitted to apply a reduced / zero rate of tax in the	Difficulties and situational character in identifying the actual beneficiary of income due to the lack of clear criteria for determining it

1	*2*	*3*
	country of origin if the recipient is the beneficial (actual) owner of the income	
The ratification by Ukraine of the Convention on Mutual Administrative Assistance in Tax Matters (EOIR standard), 2009.	Provision of mutual administrative assistance by the member states (parties to the Convention) for the exchange of information (simultaneous tax audits, participation in tax audits abroad, etc.) and assistance in collecting taxes	1. Applicability of the Convention to the member states only 2. Absence from the tax authorities of real access to banking information (including beneficiaries)
Joining the OECD Global Transparency and Information Exchange Forum (2013)	Introduction of international financial and tax information transparency standards	Formality of compliance with international transparency standards
Ratification of the US Tax Compliance Agreement and the Implementation of the US Foreign Accounts Tax Law (FATCA) (2019)	1. Implementation of standards for the exchange of information on financial accounts, which are taken as the basis for the automatic exchange of information in accordance with international treaties. 2. Cancellation of bank secrecy	1. Partial implementation of the measure due to lack of relevant tax changes in the Ukrainian legislation. 2. Lack of required software

Source: developed by the author based on [7; 8; 9]

One of the reasons for the slow modernization of the tax system in Ukraine is mainly *the declarative nature of measures and decisions* in this area that are often *not coherent and uncoordinated.*

Declared actions under the BEPS Plan and other international standards (the FATCA Treaty, the MLI Convention on Measures to Improve Double Taxation Treaties [10], CRS, CFC rules, etc.) are predominantly formal in today's realities of Ukraine. In addition, the lack of measures to prevent the outflow of capital abroad and the failure of the state to receive tax revenues in full determines the *reactive nature of deoffshorization policy* in Ukraine, focused solely on eliminating negative phenomena and processes.

The low level of financial and tax information protection and security, its partial compliance with the criteria of completeness, quality and transparency in accordance with the requirements of EOIR/AEOI CRS standards developed by the OECD and approved by G 20 countries, significantly impede Ukraine's integration into the global information space. In fact, Ukraine's accession to the EOIR standard in 2009 is declarative because it is not provided with practical implementation mechanisms. At the same time, the implementation of the AEOI requires the involvement of competent authorities in the Multilateral Agreement on the automatic exchange of financial accounting information and is scheduled for 2020.

Another drawback of anti-offshore policy in Ukraine is the low efficiency of the transfer pricing institute, which in developed countries is one of the most effective tools to counteract the transfer of assets to offshore jurisdictions. Positive changes in this regard occurred by introducing the amendments to the Tax Code of Ukraine (clause 39.2.1.7, Article 39), according to which, starring from 2018, the quantitative transfer pricing criteria (criteria for transactions between a non-resident and its permanent establishment in Ukraine are recognized as controlled) were updated. Thus, in particular, the requirement on the amount of annual income of enterprises was tripled (from 50 to 150 million UAH), and the requirement of the volume of business operations of a taxpayer with each counterparty – duplicated (from 5 to 10 million UAH) [11]. Such changes require only large enterprises to submit audits regarding transfer pricing rules, thus offloading small and medium-sized businesses. At the same time, despite

the considerable potential of the transfer pricing institute, the results of its implementation in Ukraine are extremely low. The inappropriate adjustment of tax liabilities on the basis of a "fair" price due to the possible incompetence of both taxpayers and fiscal authorities, as well as the subjectivity of such adjustments due to different valuation methods, conceal the *risk of increasing the tax burden*. A separate threat is the *potential misuse of transfer pricing tax audits*.

A number of system deficiencies (policy formality, inconsistency of actions between different authorities and agencies, corruption component, weak political will), which create the risk of *non-implementation (partial implementation) of measures planned under BEPS*, were identified in the area of planning and designing of the deoffshorization policy. Despite the developed "roadmap" of the project implementation, the main problem is *delaying the process of updating the tax legislation in force* and harmonizing it with international requirements. In addition, due to the lack of relevant regulations in Ukraine, there is a likelihood of *problems with the implementation of the Multilateral Convention* on the Implementation of Measures Concerning Tax Treaties (MLC) provisions to counteract the tax base erosion and profit shifting (MLI) (actions 6, 7, 14 of the BEPS Plan).

An important trend in global anti-offshore policy is the elimination of barriers and the establishment of cooperation between countries in the exchange of financial and tax information. Ukraine formally supports such initiatives (EOIR, FATCA), however, due to insufficient data quality and the lack of security, high level of confidentiality of banking information (in particular, regarding beneficiaries of income of economic entities) and, most importantly, lack of necessary software, there is a serious risk of *delay in Ukraine's accession to the Multilateral Competent Authorities Agreement* on Common Reporting Standard (MCAA CRS) and the *final implementation of international EOIR/AEOI standards*. Such risks entail the threat of *distrust in the Ukrainian fiscal authorities and the financial and tax system* as a whole by other states and international structures.

In general, the more regulated the processes of the dark monetary flows to the offshores are, the more complex the schemes of avoiding such regulation become. At the same time, the success of reforming the tax system and the introduction of effective practical tools for deoffshorization of the economy are the flagships of a state's international image and the basis for the formation of the so-called "national economic patriotism". In order to achieve such ambitious goals in the face of external pressure and internal instability, Ukraine must first and foremost work to strengthen its own economy, increase its investment attractiveness, achieve financial protection and security.

As a result, it is obvious that Ukraine should not focus on rigorous deoffshorization methods, but on "soft" (often indirect) measures related to enhancing property protection, information security, liberalizing currency regulation, reducing the impact of a corruption factor, while minimizing the risks that accompany these processes.

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IMPORTANCE OF DEVELOPING MODERN CONTROL METHODS FOR DETERMINING THE SAFETY OF FOOD PRODUCTS DURING CUSTOMS CLEARANCE

Abstract. This article presents an analytical review on the issues of international legal provision of food security. The paper highlights and systematizes the principles of hygienic control of food products obtained using genetically modified sources. The necessity of creating a national system for ensuring the safety of genetic engineering activities on the basis of post-registration monitoring of this type of goods is shown.

Keywords: hygienic control, genetically modified sources, equivalence principle, transgenic products, registration, food products, labeling, processed products, agricultural products.

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ВАЖНОСТЬ РАЗРАБОТКИ СОВРЕМЕННЫХ МЕТОДОВ КОНТРОЛЯ ДЛЯ ОПРЕДЕЛЕНИЯ БЕЗОПАСНОСТИ ПИЩЕВОЙ ПРОДУКЦИИ ПРИ ТАМОЖЕННОМ ОФОРМЛЕНИИ

Аннотация. В данной статье представлен аналитический обзор по вопросам международно-правового обеспечения продовольственной безопасности. В работе выделены и систематизированы принципы гигиенического контроля за пищевой продукцией, полученной с использованием генно-модифицированных источников. Показана необходимость создания национальной системы обеспечения безопасности генно-инженерной деятельности на основе проведения пострегистрационного мониторинга данного вида товаров.

Ключевые слова: гигиенический контроль, генно-модифицированные источники, принцип эквивалентности, трансгенные продукты, регистрация, пищевая продукция, маркировка, переработанные продукты, сельскохозяйственная продукция.

Важнейшей функцией органов государственной властиявляется обеспечение продовольственной безопасности государства, представляющей собой один из приоритетных показателей устойчивости системы экономических, социальных и экологических параметров, определяющих качество жизни населения и являющийся критерием оценки эффективности государственного управления.Концептуальным фундаментом её реализации выступает контроль качества потребляемых населением продуктов питания, которые не должны содержать потенциально опасные для жизни и здоровья людей компонентов, в частности, генетически модифицированные ингредиенты.

Однакозаконодательная база регулирования производства и использования трансгенных продуктов находится в процессе формирования. Такая тенденция касается не только отдельных стран, но и международных нормативных документов. В связи с особыми требованиями к качеству генетически модифицированных продуктов, они должны учитываться в производстве и торговле отдельно от традиционных, а также войти в Товарную но-

менклатуру внешнеэкономической деятельности Республики Узбекистан в виде отдельной категории (подсубпозиций), в том числе иметь свои стандарты и торговые классификаторы.

На сегодняшний день, население земного шара достигло 7 миллиардов и, увеличится вдвое в последующие 50 лет. Обеспечение продуктами питания населения планеты становится все более проблематичным, в связи с чем, ГМ-продукты могут помочь разрешить эту проблему несколькими путями, в частности:

- выведены ГМ-овощи и фрукты, способные защитить себя от насекомых и сорняков;
- повышается урожайность, качество;
- понижается себестоимость продукции;
- существуют ГМ овощи и фрукты способные противостоять вирусам, бактериям и грибкам, переносить заморозки, которые в обычных случаях уничтожили бы урожай, что в свою очередь расширяет зону агрокультуры[1; 2].

В современных условиях развития сельского хозяйства и общества, существует несколько дискуссионных точек зрения по вопросам определения основных задач генной инженерии в области создания трансгенных растений (табл. 1).

Таблица 1.– Основные задачи генной инженерии в создании трансгенных растений в современных условиях

Направление	**Желаемые результаты**
Получение гибридов	Самонесовместимость
	Мужская стерильность
Рост и развитие растений	Изменение габитуса растений – высоты, формы листьев и корневой системы
	Изменение в цветении – строении и окраске цветков, времени зацветания
Питание растений	Фиксация атмосферного азота небобовыми растениями
	Улучшение поглощения элементов минерального питания
	Повышение эффективности фотосинтеза
Качество продукции	Изменение состава или количества сахаров и крахмала
	Изменение состава или количества жиров
	Изменение вкуса и запаха пищевых продуктов
	Получение новых видов лекарственного сырья
	Изменение свойств волокна для текстильного сырья
	Изменение качества и сроков созревания или хранения плодов
Устойчивость к абиотическим факторам стресса	Устойчивость к засухе и засолению, жароустойчивость
	Устойчивость к затоплению
	Адаптация к холоду
	Устойчивость к гербицидам
	Устойчивость к кислотности почв и алюминию
	Устойчивость к тяжёлым металлам
Устойчивость к биотическим факторам стресса	Устойчивость к вредителям
	Устойчивость к бактериальным, вирусным и грибным болезням

Как свидетельствуют показатели, представленные в (табл. 1), существует определённая экономическая выгода от внедрения биотехнологии в производство в настоящем и будущем в различных государствах. Однако, в настоящее время, мнения учёных, по вопросам потенциальной выгоды современной биотехнологии, безопасности и практического использования ГМ-продуктов

и ГМ-организмов, достаточно противоположны. Экологи, религиозные организации, некоторые ученые и простая общественность, часто выступает с критикой ГМ-продуктов. Одна из основных причин таких противостояний заключается в том, что большинство стран не имеет законов, регулирующих производство и потребление ГМ-продуктов [3, 4]. Появление ГМО с комбинированными признаками, полученными с помощью методов гибридизации и рост мировых объёмов их производства, определяет необходимость формирования научно-обоснованных подходов к оценке потенциальных рисков применения ГМО и обеспечению надлежащей охраны здоровья населения на основе совершенствования процедуры государственной регистрации этих ГМО не только за рубежом, но и в Республике Узбекистан. Среди основных факторов риска, обуславливающих возможное, негативное влияние на организм человека, можно выделить следующие показатели, в частности:

- потенциальная патогенность ГМО;
- потенциальная токсичность ГМО и новых продуктов питания;
- потенциальная аллергенность ГМО и новых продуктов питания;
- возможность горизонтального переноса генов устойчивости к антибиотикам от ГМО патогенной микрофлоре желудочно-кишечного тракта человека;
- нецелевое воздействие привнесённых конструкций на другие организмы, которые потенциально может привести к подавлению нецелевых генов.

Приведённые индикаторы рисков по-разному соотносятся с различными типами ГМО. Для ***трансгенных организмов***, полученных в результате встраивания новых, не свойственных данному виду генов, характерны такие типы рисков, как токсичность или аллергенность, непреднамеренные эффекты генной модификации и как результат, ухудшение потребительских свойств, в том числе горизонтальный перенос трансгенов другим организмам. В отношении***цисгенных организмов***, полученных в результате манипуляций с собственными генами, риски, связанные с токсичностью, аллергенностью и плейотропным действием генов, характерны в меньшей степени, чем риски нецелевого воздействия и горизонтальный перенос маркерных генов [5–7].

Современные аспекты получения генно-модифицированных компонентов в продуктах питания. Для создания генно-модифицированных организмов разработаны методики, позволяющие вырезать из молекул ДНК необходимые фрагменты, модифицировать их соответствующим образом, реконструировать в одно целое и клонировать – размножать в большом количестве копий. Организмы, подвергшиеся генетической трансформации, называют трансгенными.Встраивание в геном организма хозяина новых конструкций, прежде всего, нацелено на получение нового признака, нехарактерного для данного организма путём селекционных методов исследования. В то же время, с приобретением такого признака, организм приобретает не только целый набор новых качеств, возникающих в результате плейотропного действия нового белка, но и свойства самой встроенной конструкции, оказывающей регуляторное действие на соседние гены [4].

В настоящее время, генетически модифицированные растения выращивают в 28 странах Земного шара, среди которых можно выделить США, Бразилию, Аргентину, Индию и Китай. В списке сельскохозяйственных культур, генно-инженерные сорта которых возделываются в этих странах, можно выделить сою, картофель, кукурузу, сахарную свеклу, томаты, тыкву, рапс. Ежегодный прирост площадей, на которых выращиваются генно-модифицированные культуры, составляют в среднем 15–18%, а экспериментальные полевые исследования проводятся в отношении более 4000 генетически-модифицированных культур. Анализируя статистические данные по вопросам выращивания

трансгенных растений, следует отметить, что на практике ситуация выглядит следующим образом: среди промышленно выращиваемых трансгенных растений доля устойчивых к гербицидам составляет 71%, устойчивых к вредителям – 22%, устойчивых одновременно к гербицидам и вредителям – 7%, устойчивых к вирусным, бактериальным и грибным болезням – менее 19% (рис. 1).

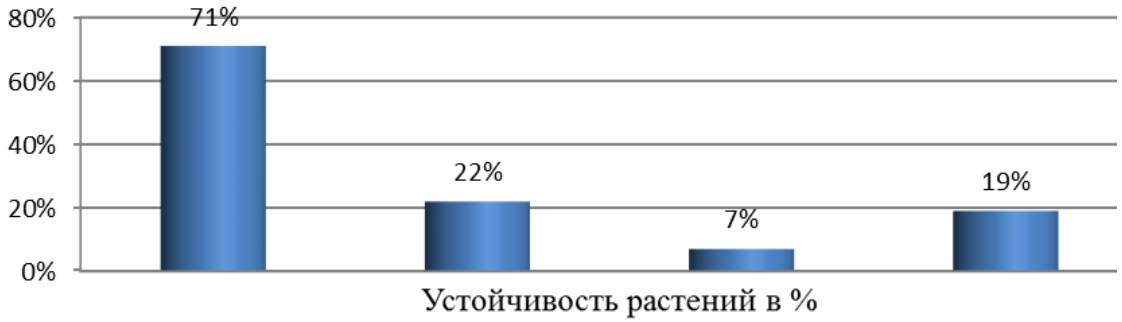

Рисунок 1. Устойчивость трансгенных растений к внешним воздействиям

Кроме того, 60% производимой в мире сои, 15% картофеля, 7% кукурузы являются генно-модифицированными, а ряд продуктов питания и блюд в США, такие как картофель фри, салаты, гамбургеры, уже полностью ориентированы на изготовление с применением технологий генной инженерии.При этом, модификация сельскохозяйственных культур направлена на поиск свойств, обеспечивающих устойчивость к гербицидам, инсектицидам, вирусам, неблагоприятным факторам окружающей среды, повышение выхода продукции, улучшение потребительских свойств пищевой ценности.

Анализируя систему контроля качества в области обращения ГМО, следует отметить, что, по принятой в Европейском Союзе системе, одобренной ВОЗ и ФАО, если в ходе изучения химического состава трансгена не обнаруживается каких-либо отличий от его традиционного аналога, данный генетически модифицированный источник пищи относят к первому классу безопасности, в отношении которого не требуются дальнейшие исследования. В тех случаях, когда устанавливаются некоторые различия с традиционным аналогом, т.е. присутствие новых или отсутствие каких-либо компонентов, можно с уверенностью идентифицировать его как второе поколение и исследования будут сосредоточены именно на этих показателях. Полное не соответствие исходному аналогу, свидетельствует о третьем классе безопасности и, в этом случае, экспертная оценка генетически модифицированного источника пищи должна быть продолжена.

Система контроля за генетически модифицированными организмами на продовольственном рынке, применяемая в Республике Узбекистан, разработана на основании практического применения Методического руководства «Порядок определения генетически модифицированных организмов в пищевых продуктах и продовольственном сырье методом полимеразной цепной реакции (ПЦР)», основанного на выявлении регуляторных последовательностей (промотора 35S и терминатора NOS) и позволяющий определить ГМО в пищевом продукте, даже если его содержание не превышает 0,9%. Такой подход соответствует современным рекомендациям Всемирной организации здравоохранения. Однако, тенденции развития генной инженерии обусловили тот факт, который позволяет утверждать о появлении ГМО второго поколения, отличающиеся отсутствием данных регуляторных последовательностей. Подобные культуры с большой вероятностью могут присутствовать на рынке Узбекистана и соответственно оставаться не идентифицированными, что представляет потенциальную опасность для населения страны. В связи с этим,

идентификация не заявленных генетически модифицированных источников пищи, а также комбинаций ГМО, является одним из актуальных вопросов в обеспечении биологической безопасности пищевых продуктов для населения и требует разработки оптимальной диагностической комбинации генетических маркеров для каждого вида пищевой продукции. Наиболее эффективным методом анализа нуклеиновых кислот является полимеразная цепная реакция в реальном времени [8–12].

Цель работы: генетический анализ качества импортируемых продуктов питания, на присутствие генетически модифицированных компонентов для задач ведения мониторинга незаявленных ГМО и обеспечения биологической безопасности пищи.

Объектами исследования: продукты питания, произведённые в Республике Узбекистан

Материалы и методы: В работе был использован метод полимеразной цепной реакции (ПЦР) с гибридизационно-флуоресцентной детекцией(***маркеры ГМО: терминатор, промотор, маркерные гены).***

Результаты и обсуждение. В ходе проведённых исследований нами были изучены статистические показатели производства различных видов продуктов питания, производимых в Республики Узбекистан. Как показано на рис. 2., в структуре проанализированных проб, преобладали мучные изделия и плодоовощные культуры, таких как кукуруза, баклажаны, картофель, мучные полуфабрикаты, сосиски, молоко и соя. Также были исследованы приправа, овсянка, перец, капуста, виноград и биологически активные добавки.

Проведённый нами метод полимеразной цепной реакции (ПЦР) с гибридизационно-флуоресцентной детекцией, предусматривал определение маркеров ГМО: терминатор, промотор, маркерные гены.Данный метод включает в себя три этапа:

1. Предварительная подготовка образцов продуктов питания;

2. Экстракция ДНК из образцов продуктов питания;

3. Амплификация фрагментов ДНК с гибридизационно-флуоресцентной детекцией.

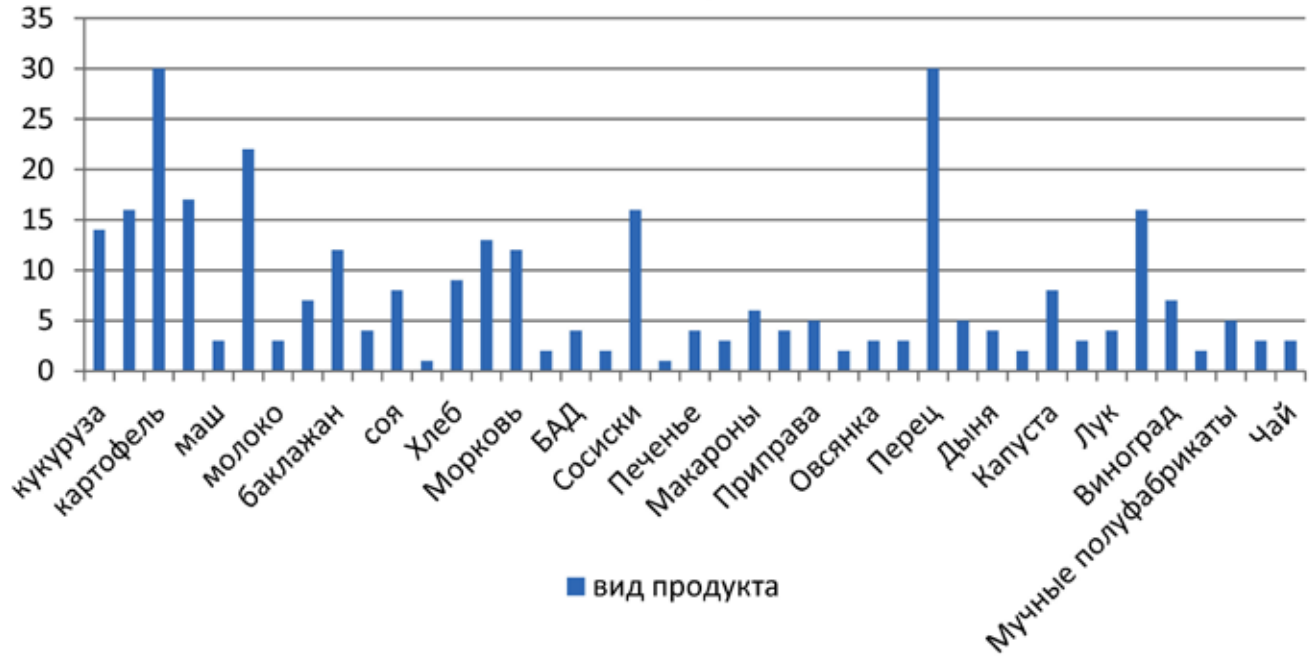

Рисунок 2. Статистические показатели по результатам исследований пищевых продуктов на ГМО в вирусологической лаборатории Рес. ЦГСЭН МЗ РУз (Республика Узбекистан)

Для экстракции ДНК использовался комплект реагентов «ДНК-сорб-С», предназначенный для экстракции ДНК из клинического материала, продуктов питания и кормов для животных. Экстракция ДНК состоит из нескольких этапов:

1. Разрушение структуры клеток;

2. Осаждение ДНК на сорбент;

3. Отмывка сорбента с ДНК от белков, липидов, вторичных метаболитов;

4. Высвобождение ДНК из сорбента с помощью буферного раствора.

Амплификация проводилась набором реагентов **«АмплиСенс® ГМ Плант-1-FL», который** позволяет обнаруживать следующие фрагменты ДНК, широко встречающиеся у генетически модифицированных (ГМ) растений: фрагменты энхансера(E-35S***CamV)***и промотора (P-35S***CamV)*** последовательности 35S вируса мозаики цветной капусты и фрагмент терминатора гена нопалин-синтетазы из ***Agrobacteriumtumefaciens*** (T-NOS).

Также в работе были проведены аналитические исследования по определению эндогенного контроля (ЭК растений), то есть ген, специфичный для растительного генома (как трансгенного, так и нетрансгенного), что позволяет определять присутствие ДНК растений в исследуемом образце.

Основную массу исследованных на ГМО пищевых продуктов составили овощи (картофель – 33, томат – 16, болгарский перец – 14, баклажан – 12, морковь – 12, кабачок – 7, белокочанная капуста – 5, патиссон – 4, свёкла – 4, лук – 4, огурец – 3, тыква – 2, морская капуста – 2, цветная капуста – 1) в натуральном виде и их содержащие продукты – 119 проб (26,3%).

На втором месте по частоте исследования можно выделить пшеницу, как в натуральном виде, так содержащие её продукты (мука разных сортов, хлебобулочные, макаронные и кондитерские изделия) – 73 пробы (16,2%).

Других зерновых, а также бобовых культур (рис – 18, фасоль – 12, маш – 6, гречка – 5, горох – 3, ячмень – 1, солод – 2, овёс – 6, чечевица – 1, рожь – 1) в натуральном виде и их содержащих продуктов исследовано 55 проб, что составило 12,2%.

Колбасных изделий, таких как: колбасы варёные, копчёные, полукопчёные, сосиски, сардельки было исследовано 42 пробы (9,3%).

Также были исследованы фрукты и ягоды (яблоко – 13, виноград – 7, слива – 5, дыня – 4, банан – 3, абрикос – 2, клюква – 1, клубника – 1, апельсин – 1, мандарин – 1, земляника – 1, маслины – 1) в количестве 40 проб (8,8%).

Особое внимание уделялось продуктам детского питания, в т.ч. молочным и безмолочным смесям, и исследовано было 29 проб (6,4%).

Кукуруза в натуральном виде и продукты из неё были исследованы в количестве 26 проб (5,8%).

Специи, как в отдельном виде, так и в наборах, в т.ч. барбарис, лавровый лист, чёрный перец, красный и зелёный стручковый перец, были исследованы в количестве 22 пробы (4,9%).

В мониторинг была включена и свежая зелень (укроп – 5, кинза – 5, сельдерей – 3, петрушка – 3) в количестве 16 проб (3,5%).

Также в состав исследованных пищевых продуктов вошли соя в натуральном виде и её содержащие продукты (салаты, соусы), которые составили 13 проб (2,9%).

Из молочных продуктов прошли исследования на ГМО 5 проб (1,1%) йогуртов и сгущённого молока.

Другие виды пищевых продуктов (халва – 3, семена подсолнуха – 3, арахис – 2, грецкий орех – 1, кофе – 1, майонез – 1, чай – 1) были исследованы в количестве 12 проб (2,6%)

На основании проведённого мониторинга распространённости ГМ продуктов в Республике Узбекистан и использования методов выделения ДНК, а также проведение ПЦР, можно с уверенностью отметить, что в исследуемых образцах не выявлено наличие генетически модифицированной сои по маркеру 35S промотора вируса мозаики цветной капусты в пищевых продуктах.

Учитывая вышеизложенное, логика рассуждения приводит к тому, что ни одна из национальных систем регулирования рынков новых продовольственных товаров, не является оптимальной, полностью удовлетворяющей требованиям субъектов торгово-экономических отношений. Расширение концептуальных стратегий и научных знаний о воздействии или, напротив, отсутствии воздействия новых типов продовольствия на здоровье человека и состояние окружающей среды, обеспечит устранение противоречий между участниками рынка и, как следствие, будет способствовать сближению национальных систем регулирования [13–16]. Эта деятельность может быть определена не только как одно из приоритетных направлений в области обеспечения продовольственной безопасности страны с учётом мирового опыта, но и как необходимость разработки административных механизмов, регламентирующих оборот ГМО и продукции на основе ГМО, в целях реализации эффективного контроля их распространения в нашей республике. Кроме того, разработка современной системы контроля качества с учётом показателей идентификации продовольственных товаров, содержащих ГМ-аналоги, с целью формирования аналитической базы данных, прогнозирования профилей и факторов рисков, а также возможных правонарушений в вопросах контроля качества и достоверной классификации согласно Товарной номенклатуры внешнеэкономической деятельности, представляет особую актуальность.

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Section 6. Economic theory

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TRENDS IN THE DEVELOPMENT OF THE MODERN ECONOMIC SCIENCE

Abstract. The main objective of the research is to identify key features of a new economic paradigm within the flow of the development of the modern economic science. We are interested in differences in subjects of Economics and Political Economy, the provisions of which form the modern economic theory. Then we discuss problems of the development of the modern economic theory, ground the need to change the market-centric paradigm and identify trends in the development of the modern economic science.

Keywords: collaboration, Economics, market, Neo-Political Economy, paradigm, Political Economy.

1. Introduction

Theory is a system of knowledge that gives a holistic view of an object or phenomenon. Economic theory is a system of knowledge about the economy at micro and macro levels. This knowledge is scientific, as it is "clothed" in certain ideas, provisions, formulas, categories and concepts.

An important feature of specific economic disciplines is their close connection with practice, as their main purpose is to teach to work in a particular area of the economy: in the field of management, accounting, banking, etc. That is why these sciences are called "applied". General economic theory is also connected with practice. This connection is carried out primarily through specific economic disciplines since they are based on a general economic theory. In addition, it provides knowledge that can be useful in life for any person. Economic theory is especially necessary for those who make economic decisions conducting economic policy at the micro level of the individual enterprise or at the macro level – the level of the entire national economy. At the same time, it helps to make the right decisions not only from the standpoint of interests of an individual but also the entire economy as a whole, the interests of the majority of people [1, 4].

Thus, in accordance with John Maynard Keynes, economic theory is not a set of ready-made recommendations applied directly in economic policy, it is rather a method than a doctrine, an intellectual method, a technology of thinking helping the one who owns it to come to a right decision [10].

Thus, the object of the research is to consider differences in subjects of Economics and Political Economy, the provisions of which form the modern economic theory; to discuss problems of the development of the modern economic theory; to ground the need to change the market-centric paradigm; to identify trends in the development of the modern economic science.

2. Subject of the economic science

Economics as an economy is a common subject of research by various economic disciplines. However, every economic discipline has its own subject of study. The essence of the subject and the differences in the subjects of economic disciplines can be seen on the example of Economics and Political Economy, the provisions of which form the modern economic theory.

Economics refers to its subject the behavior of people in the economy determined by their unlimited needs and limited opportunities to meet these needs. By stating the unlimited needs of people Economics means people living in a market economy, the very development of which determines the growth of human needs. The market economy does not just react to this growth, but it provokes it creating things that people did not need before. Advertising is particularly sophisticated for this purpose – advertising services can range from simple customer information to the real advertising terror. However, it is not possible to acquire a huge variety of things, that appear on the market, for any person, even the richest. Thus every person in the market has to make a choice taking into account their budget constraints.

Those who produce goods are also in the situation of choice. This choice is again due to the limited resource capabilities of manufacturers. Based on these possibilities they produce only certain kinds of things and in a certain amount. Each manufacturer faces questions: what, how much and how to produce? Economics calls these questions fundamental, and it refers the answers to them to the subject of its research. These responses are determined by the action of the market mechanism. It turns out that the *subject of Economics* is the behavior of people as economic actors of the market economy.

The subject of *Political Economy* is more general. This science proceeds from the fact that in order to satisfy people's needs they must be engaged into the production of necessary goods, entering into appropriate relations with each other – relations about the production of necessary goods. They have to distribute the goods produced among themselves and, if necessary, exchange the results of production. Thus there is a relationship of distribution and exchange between people. Finally, they have to consume what is produced to satisfy their needs. Here are relations of consumption. Thus the totality of relations concerning production, distribution, exchange and consumption constitutes the *subject of Political Economy*. Moreover, these relations are considered as objective, subject to laws independent on the will and desire of people. The operation of these laws is also the subject of Political Economy.

The subject of Political Economy is broader than the subject of Economics, since the relations of production, distribution, exchange and consumption and the laws governing them do *not* arise *only* in a market economy. In addition, Economics analyzes a sufficiently developed market economy paying attention to the existing functional relations in it, while the broad approach of Political Economy to the system of economic relations determines the allocation of relations between people as representatives of different classes and social groups [1, 7–9].

The subject of *modern Economic Theory*, reflecting the approaches and positions of both Economics and Political Economy, is the economic relations that arise between people about limited goods, and that determine their behavior as economic entities in the production, distribution, exchange and consumption of these goods. From this definition it follows that economic relations are studied not by themselves but in close connection with the topics about which they arise, especially those that constitute the material and technical basis of a society. Since the behavior of people as economic entities is determined not only by the economic relations in which they enter, but also by non-economic factors (for example, the norms of morality, the level of culture, legislation) the economic theory does not ignore these factors. Thus its subject is broader than economic relations itself.

3. Problems of the development of the modern economic theory

In the world development a stalemate was found because the premise on which the previous technological expansion was based (the idea of the inexhaustibility of natural resources in the limitless possibilities of nature to restore the disturbed general equilibrium) collapsed. In turn, the contradiction that arose a little earlier in the so-called "pure economic science" also manifested itself in full, expressed in the elimination of rigid determinism of such factors as "technology – man" and the change of priorities in the sphere of motivation of social and labor activity [10].

These global problems faced by humanity are sometimes referred to as the "crisis syndrome of world development", implying a whole host of unprecedented crises such as economic, energy, food, demographic, raw materials, environmental and also socio-psychological [18]. In the words of O. Toffler, this crisis is not capitalist or socialist but industrial-technocratic in which the need for the existence of the traditional basis of society with its goals, the desire for economic growth, culture, morality, established economic principles, traditions, scientific criteria are very persistently questioned [17, 118].

Z. Brzezinski who always believed in the crisis of communism, as well as in the inviolability of Western European civilization with all its basic attributes, analyzed of what was happening in the world (supplemented by rapid events in Eastern Europe) and came to a state of great uncertainty about the future [2, 112].

The expansion of mainstream of Economics (neoclassical theory) has been widely manifested in university curricula and in textbooks that have been published over the past decades but differ little from each other. The neoclassical approach with its traditional sections such as Microeconomics, Macroeconomics and the World economy (not in the best author's versions supplemented sometimes by local material taken out of context) presents in literally all books on economic theory [5; 7]. It is also noteworthy that Western textbooks on economic theory also tend to avoid many acute problems and conflicts that take place both in modern real life and inherent in neoclassical theory. For example, axioms of theory and models construction, theses on preferences, problems of economic development, debatable questions of Walras-Arrow-Debreu general equilibrium, institutional conditions of applicability of various theoretical constructions and models remained without attention.

The methodological weakness of neoclassical theory is that it uses microstatic theorems, which lack technological progress and the increase in available resources to predict the course of events in the real world.

Criticism of Economics is also contained in the collection of works of leading American economists "Why the economy is not yet a science?" Thus, W. Leontief criticizes Economics for extreme formalization. P. Wiles highlights such weakness of Economics as extreme abstractness which is not tied with the reality. His main message is that "in the long run, without a protective methodology and a limited vocabulary, ideology cannot last. Before the scientific method was agreed upon, special methodologies were legion. Now they arise only to protect ideologies" [11]. It is worth mentioning the increased role of politics and ideology which not only covered the economy internally but also externally, provided it with a "protective shell" [10]. This is admittedly the heart of the modern economic system: an economic and political ideology based on enslavement through debt and imposed by paralyzing fear (like Muslim terrorism, immigrants, or anything else threatening to rein in corporations) [12, 208–209] … Fear and debt are the two most powerful tools of global oligarchic capitalism, which would have free rein through economic globalization and the mythical qualities of a "free market" economy.

Recognition of the crisis of economic science in general makes it possible not to be again unarmed and defenseless in the face of a completely new civiliza-

tion in the broad sense. According to such scientific authorities as J. Nesbit and T. Masuda it requires the construction of an absolutely new scientific paradigm that is free from traditional concepts and designs. Understanding this process allows, in turn, to treat the conclusions of science with a certain methodological caution and foresight. However, as the history of economic theory shows, it is extremely rare to address to the problems of theory when the critical level of disintegration of both practice and science exceeds all possible permissible parameters [9, 61–62].

4. The need to change the market-centric paradigm

Modern economic theory with all its variety of schools has (leaving aside unpopular Marxism and schools close to it) some amazing property: Monetarists and Keynesians, Neo-institutionalism and Dirigisme – almost all of them (as well as in the textbooks representing these theories) the center of the universe is the *market*. Looking at any Economics textbook you can immediately see how the characteristics of the economy in general almost without any reservations turn into characteristics of the market: supply and demand, money, capital, budget constraints, profits. Another economy, if mentioned, is an exception, economic goals and motives, in fact, are reduced to *money*. In this sense, modern Economics takes a step back even compared to A. Smith [3, 37]. If you ask yourself whether the concepts of "economy" and "market" are identical, the answer is negative. In this context it will be useful to recall K. Marx who said that that the market capitalist system is the most developed *type of "economic social formation"*. But if this question is not raised…

Today there is an interesting situation in economic theory because the XXI century repeats (and in many ways in the form of a farce) the situation of the seemingly universal and eternal domination of the market-bourgeois system of the century before last. Then for the final victory and now for the self-preservation and preservation of this system, the other than the "market-centric" economic theory is not necessary and even dangerous [4].

First, for economic entities, practically (and not only ideologically) fused with the market system, a different theory is not needed. Their real economic life is reduced to the choice of solutions where the criterion is the maximization of monetary wealth and its derivatives in the short or long run. Accordingly, they need a science clearly tied to these practical problems, and the "market-centric" theory in principle copes with the solution of these problems.

J. Perkins reflects on the theoretical bases that justifies the modern economic policy affecting the whole world. He writes: "Friedman's "maximize profits" credo was promoted by government and business leaders on every continent. Concerns about social welfare, the environment, and other quality-of-life issues took a backseat to greed. In the process, an overwhelming emphasis was placed on promoting private business. At first, it was justified on theoretical basis, including the idea that capitalism was superior to and would deter communism… Eventually, such justification was simply accepted a priori that there was something inherently better around projects owned by wealthy investors rather than by governments. International organizations such as the World Bank bought into this notion, advocating deregulation and privatization…" (M. Friedman had won the Nobel Prize in Economics by maintaining that the only goal of business should be to maximize profits, regardless of the social and environmental costs, and that government oversight, in general, was unnecessary and counterproductiv) [12, 173].

Secondly, this theory protects these subjects from any unnecessary, dangerously critical statements and questions indicating the presence of other, non-market worlds. It theoretically "proves" that there is no other world, it seems to be as if it were not (since the theory stubbornly "forgets" about non-market production, distribution and consumption, then "mere mortals" should not know about them) and certainly never will.

Third, any school of theory that indicates that the market is not the only possible structure of life is dangerous, as the heliocentric model of the structure of the Universe was dangerous in its time: in both cases ruling forces reject knowledge harmful to them. To preserve the dominance of the global hegemony of capital and "market fundamentalism" (the term of J. Soros) active propaganda of theoretical views, showing that the market (as economic system serving greater part of transactions of the major part of humankind) terminally won only in … late XIX – the early XX centuries, is dangerous. Humankind many centuries before painfully tried to move to the market and the capital paying for this price bloodiest wars and revolutions, colonial oppression and camping, etc. Note that Economics generally "sees" only developed systems, and even exclusively the American economy, leaving to the share of special disciplines that lie "on the other side" of economic theory – Comparative and Development Economics – the economic life of 4/5 of the inhabitants of the planet.

Even more dangerous is the trivial question: if the market is a special form of coordination, one of the many historically existing forms of resource allocation, and if it once (as the dominant form – only 100–200 years ago) arose and is (like all other economic systems) historically limited, does not this mean that the market economy has not only a beginning, but also an end? Thus, a serious theoretical analysis of real post-market and post-capitalist relations will be absolutely harmful. This analysis is dangerous not only because it awakens excessive inquisitiveness of mind and harmful questions (for consumers and producers completely subordinate to the market) but, above all, because it shows:

- historicity of the market economy as a system that once arose and – like all historical forms – once had to develop into another economic system;
- the real contradictions of the market-capitalist economy causing the possibility and necessity of its decline;
- the difference between the apparent mechanisms of its functioning and the underlying (and hidden transformed forms) essential features of commodity relations and capital;
- elements of real non-market (and post-market) relations in the world economy;
- theoretical models that explain who, how and why can and will contribute to the "birth" of new relations intending to replace the market and the capital.

5. Trends of the development of the modern economic science

If we turn to the analysis of economic science in the broad sense, we can see that it does not stand still in its development. What very significant in the resolving power of such an economic science is its foundation and paradigm which also changes in the evolution of economic life itself. The new paradigm of modern economic science already has very real outlines [6].

First, its subject has expanded to the international level, the properties of which have become dominant in the national economic development.

Secondly, the subject is transferred from the usual, peculiar to Economics, to the plane of studying the laws of development, similar to what classical Political Economy was engaged in, which allows us to put forward as a working term for its definition as *Neo-political Economy* [8; 13]. The consumer of its conclusions are international organizations that form the "world economic order", national governments and other major economic actors.

Third, out of all the factors of production, the human factor, sometimes called "human capital", is beginning to emerge as the main factor for economic growth.

Fourth, the achieved level of development of productive forces, the aggravation of global problems gives a reason to replace the framework of *homo economicus* (which asserts that humans are rational actors who make decisions based on narrow self-interest) with a model that reflects humans' capac-

ity for altruism and pro-social behavior. Here the motivation of profit maximization is not the main goal of a person. A society with its many regulatory measures, including education, morality, ideology, law, etc., acts as a limiter. Additionally, experimental data suggest that, contrary to mainstream economic theory, people's preferences are changeable. For example, shifting environmental factors shape human decision-making by activating motivational systems related to threat as well as to care for others, etc. [15].

To dive deeper into the latter issue, it is wondering, why do so many of us still cling to this unflattering view of the human species as a selfish animal? Why do we assume the worst about humankind? In accordance with Y. Benkler [1, 15–16], there are four reasons. First, the assumption of human self-interest is partially correct. Second, the historical moment at which the concept of selfishness and self-interest rose to prominence in our culture is important. Third, we desire simple, clear elegant explanations about ourselves and the world we live (even if those simple explanations are wrong). The forth reason is the fact of the mere force of habit and its ability to distort our perception and thinking.

In the last, in the new fundamental science, overcoming interdisciplinary and the "defect of knowledge", the concept of "competition" also acquires a different shade and meaning since it has come in its impact from the *posteriori* level to the *a priori* level. We are talking about competition in the minds at the level of forecasting, modeling and planning, i.e. the supposed "pre-production competition" which in this form leads to lower costs and influence on the amplitude of the cycle. For example, applied game theory, rational and adaptive expectations is a proof of this.

A new emerging paradigm of the economic theory is ready to break free of the selfishness myth and embrace human cooperation as the powerful and potentially positive force that it is (cooperation against competition as the attribute of the market economy). People have already looked to ways they can harness cooperation and collaboration to improve the system they inhabit. For an instance, the Internet has given us countless, easier and more rewarding platforms for collaboration and voluntary cooperation. People search for information on the web, query strangers, get answers from people they did not know, would never know, for reasons they did not need to ask about, and all is for free; people are engaged in solving social problems or even brainstorming. In other words, nowadays people manage to find different ways to integrate voluntary. This is a new reality. It happened for the reasons mentioned above (drawback of the market economy and limitations of the subject of the mainstream of Economics). "When any relatively stable and coherent system – an economy, a country, or a community – suffers a shock, it leads to a new flexibility, a new openness to different ways of explaining our world and organizing our lives. This is the way we come to reexamine old practices, try new ones, and adapt to the changes happening around us" [1, 24].

Nowadays Economics is a powerful factor in governance, setting the scope and norms of human behavior. Therefore, in universities it is taught very selectively in its content and methods. In general, this situation corresponds to the world division of labor and the established main political and economic forces.

First, it is the science that studies and expounds cardinal (global) changes in the world economy and in turn forms the world economic policy and the "new economic order". Higher technological structures that produce unique, non-serial products, political and economic relations are in its orbit of research. This sector lacks the traditional competition described by "traditional" economic science.

Secondly, it is the economic theory which investigates the laws of the functioning of sectors of the economy producing mass production for the mass consumer. Here advanced courses of traditional Economics can still perform to some extent its theoretical function. Assessing the level and problems of the development of economic science in general,

W. Leontief noted that it is difficult to explain why for so long researchers working in such related fields as demography, sociology and political science, on one hand, and ecology, biology, health sciences, engineering and various applied disciplines, on the other hand, will refrain from expressing concern about the isolation in which economists-theorists now find themselves [11].

Third, it produces economic knowledge for the masses living in the mining regions. The level of development of the productive forces in these countries is such that in addition to the motivation of labor, kitsch knowledge is relevant here, with the help of which it is possible to manage this "audience" without any war and violence. After passing the appropriate tests the most capable of generating scientific knowledge can receive invitations to well-known scientific centers. The less able, receiving some financial and moral support in various forms, are engaged in *replicating* in these countries kitsch knowledge from the field of Economics calling it science.

So if we want economic order in life we have to put order in the minds that is what National Economics has to do. It so happens that the importance of the latter at critical points in the historical development of the country is much greater than it is sometimes thought. It is impossible to consider the "planetary village" (which the world community represents today) through the "keyhole" which we have created for ourselves, uncritically referring to the authoritative but already insignificant categorical apparatus of orthodox economic science. If we take into account the transience of our entire era, we can safely say in the words of P. Sztompka: "Interest in the big theory arises in society in the era of radical social changes" [16].

6. Conclusions

Economic theory is not a set of ready-made recommendations applied directly in economic policy, it is rather a method than a doctrine, an intellectual method, a technology of thinking helping the one who owns it to come to a right decision.

The subject of Economics is the behavior of people in the economy determined by their limited opportunities and unlimited needs which they meet living in a market economy, the very development of which determines the growth of human needs.

The subject of Political Economy is the totality of relations concerning production, distribution, exchange and consumption. These relations are considered as objective, subject to laws independent of the will and desire of people. The subject of Political Economy is broader than the subject of Economics since the relations of production, distribution, exchange and consumption and the laws governing them do not arise only in a market economy.

The subject of modern Economic Theory, reflecting the approaches and positions of both Economics and Political Economy, is the economic relations that arise between people about limited goods, and that determine their behavior as economic entities in the production, distribution, exchange and consumption of these goods.

Crisis syndrome of the current world development implies a whole host of unprecedented crises such as economic, energy, food, demographic, raw materials, environmental and also socio-psychological.

Economics, presented by the neo-classical economic theory, tends to avoid many acute problems such, for example, as theses on preferences, problems of economic development, debatable questions of Walras-Arrow-Debreu general equilibrium, institutional conditions of applicability of various theoretical constructions, etc.

Fear and debt are the two most powerful tools of global oligarchic capitalism, which would have free rein through economic globalization and the mythical qualities of a free market economy.

The economic life of the free market economy is reduced to the choice of solutions where the criterion is the maximization of monetary wealth and its derivatives in the short or long run. Concerns about social welfare, the environment, and other quality-of-life issues took a backseat to greed. Privatization

and deregulation was justified on theoretical bases and advocated by international organizations.

To preserve the dominance of the global hegemony of capital and "market fundamentalism" any school of theory that indicates that the market is not the only possible structure of life is considered to be dangerous. Economics generally takes into account only developed economies (like the American economy) leaving aside Comparative and Development Economics – the economic life of 4/5 of the inhabitants of the planet.

The market-centric economic system is historically limited. There is the need to change the market-centric paradigm since real post-market and post-capitalist relations begin to show (international level of the subject of the research, neo-political economy, human capital as a new factor of the economy, pro-social behavior pf people, cooperation instead of competition, changeable preferences in view of shifting of environmental factors).

Humans are capable of far more than selfishness and materialism. We are capable of building sustainable, equitable, and caring political systems, economies, and societies. Institutional reform could be aimed at adapting social environments to foster cooperation instead of competition, and to activate our motivation to engage in caring behavior, rather than seeking achievement, power, and status only.

If we want economic order in life, we have to put order in the minds. We should critically refer to the authoritative but already insignificant categorical apparatus of orthodox economic science because nowadays people manage to find different ways to integrate and collaborate. This is a new reality which happened due to the drawbacks of the market economy and limitations of the subject of the mainstream of Economics.

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