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## PROBLEMS OF POST-WAR RESTORATION AND DEVELOPMENT OF INFRASTRUCTURE IN UKRAINE

### 1. The Role of Infrastructure under Current Conditions

The damage Ukraine sustained because of the military activities amount to catastrophic sums. It refers to residential domain, transport, trade, industry, energy and extractive industries, agriculture, education, tourism and culture objects, water supply and sewage, health-care, environment and forestry, telecommunications and IT. The large ratio of this damage is made by infrastructure. Therefore, the future programme of overcoming war outcomes and recovery of Ukrainian national economy in the post-war period, and thus renovation of economic and social sphere, development of defense industry sufficient to provide national security must be closely connected with infrastructure, along with the other components.

On the other hand, the high level of infrastructure development in the country, comparable to the European one, is one of the most important precursors of Ukraine's economy successful entering European economic space and the entrance to EU.

Meanwhile, the views of programmes on overcoming war outcomes and post-war development creators [1], including the domain of Ukraine economy, e.g. [2-4] tend to vary greatly. However, they lack key formula that would lead Ukrainian society to effectively achieve the necessary ultimate result. For instance, very few remember the details of State Commission of Russia Electrification Plan (GOELRO) that was adopted in 1920, still the formula "...plus electrification of the whole country" remains in the memory of generations.

Besides, it is logical to consider that ultimate solutions as per relevant issues of normal situation recovery are to be made after overall and detailed analysis of approaches, action of all main factors and mechanisms of implementation, and evaluation of non-implementation results, while the programmes quintes-

sence must be grounded and clearly directed to the future, as "generals are often prepared to fight the last war"<sup>1</sup>. This quotation by Winston Churchill may be proven not only theoretically [5], but also by real historical examples. Thus, during the time of USSR collapse instead of choosing the way of Donbass alternative development with utmost restructuring of coal mining, ineffective in complicated subsurface conditions, it was decided to leave the situation without any essential change in the branch. Inconsistency that resulted from contemplations on that the issue of Donbass resolving must be transferred to a more convenient time [6], influenced the further unrolling of events in this industry and the region as a whole and brought even more tragic outcomes.

It's a paradox that even the United Nations experts do not require the definition of key strategic formula main components. The must for them is the long-term planning (up to 50 years with parcellating into five-ten years cycles), thinking by the categories of "great strategies and great undertakings", defining bifurcation point as its condition promotes raising one step higher even though with a high risk of downward slide [7]. The probability of civil catastrophes in bifurcation point grounds the relevance and need to tackle them by compensatory measures. It is exactly this position that we need to evaluate the recent and, by and large, constructive scientific work of the scientists from academic and higher educational establishments.

Thus, e.g., "...building up strategic goals in recovery and defining its branch vectors are of top importance for Ukraine even today. One could include to branch vectors of recovery the transformation of economics structure by means of innovation renewal of industrial capabilities using organisational and economic factors implementation based on new information technologies in such branches as machine

<sup>1</sup> Generals are always fighting the last war. Winston Churchill.

building and defense industry, steel, food, chemical, pharmaceutical and timber industries, as well as in new spheres of activities like bio- and nanotechnologies. In order to move along these vectors efficiently, state policy activities must be planned and implemented to create the rational structure of new industrial complexes in the regions, including also their relocation, renewal and development of new logistic schemes and to build enterprises able to substitute the production-sales chains destroyed by Russian aggression, along with the holistic strategic planning scheme" [2]. Otherwise, "...comprehensive solution of social and labour issues requires, with no exaggeration, global, or, to be more exact, neoglobal goal setting and mega views on how to achieve these goals. We have no doubt that the best social labour policy is the leveraged, highly professional and innovation oriented economic policy with such basic subsystems as socio-demographic, socio-labour, investment, technical and technological, innovation, financial and institutional, which could ideally become the components of Ukrainian "Marshall plan" [3]. Moreover, «...forming a new economic model as the basis of economy recovery must follow the way of new industrialization characterised by transition to principally new technics and technology. The inner interrelation between technical renewal of industry and economic development must become an immanent feature of post-war Ukraine market economy... New industrialization must begin with installation of such enterprises that could continue technological chain of raw materials production and easily substitute import. Added value in industrial branches is always sufficiently higher than in the ones of raw materials. This envisages new high technology jobs creation that will produce higher added value and provide the increase to population real income" [4].

This being well said; however, we would like to continue discussing recovery issue from point of view we have expressed above. Consequently, post-war recovery of Ukraine must be linked not with infrastructure per se, but in its wider definition, which formulates the goal of current work, i.e. to prove that it is infrastructure development that must be an important component of the formula to further state economy restoration strategy and its social sphere.

We consider viable the following frame to vividly demonstrate the role of infrastructure in the modern world: there's a huge number of electrical appliances in the world and all of them, whatever purpose they might be used for, require electricity to operate – this could be either electric cord, or battery or accumulator, but it is inevitably necessary. The same applies to infrastructure as it is inevitably necessary for every sphere of life, be it transport, industry, social sphere, healthcare or education... everything needs its own infrastructure.

The category of infrastructure in the meaning of roads, bridges, canals, ports, airports, and communication systems was introduced at the end of the 1930s,

while in the 1950s the stage of infrastructure development was used as the third, along with labour and capital, factor of macrolevel production function [8]. Today economic infrastructure is a complex of branches and activities that serve production and a state as a whole. While social infrastructure, in its turn, is the complex of branches and enterprises that provide normal functioning of population, including ones in industry, healthcare, pre-school, school, secondary and professional education. Also, the various types of infrastructure are differentiated, i.e. informational, military, innovation, market, space, touristic, etc.

In some countries economics infrastructure is divided into production and social (non-production) spheres, that is, refer science to infrastructure. In general, national economy infrastructure is the complex of branches and activities creating the basis of national economy and simplify and make more efficient the goods and services flow. Therefore, any event in post-war development of Ukraine and preparation to entering the EU is at the end of the day the development of exact infrastructure types and, consequently, the further action strategy will result from prospective "infrastructural" development.

The definition of infrastructure is so refined that it is not always possible to differentiate infrastructural component per se. «If the world were ruled by logics, – as had stated "The New York Times" just two days before the first Moon expedition, - one of honorary places on Cape Kennedy during Apollo-11 launch would be taken by Mykyta Khrushchov, USSR ex-President, and the former first secretary of soviet communist party" [9]. This passage was explained by the fact that the then USSR defense industry to a certain extent became the infrastructure for the USA space industry development, the launch of the first soviet artificial satellite caused psychological condition in the USA that was called "sputnik moment", "sputnik crisis". John Kennedy who followed Dwight Eisenhower as the US President, who was not the supporter of space race, increased the grade of opposition to the military one on the wave of "sputnik", which provided Werner von Braun, at that time American constructor, with the outstanding investment and mobilization opportunities.

Another example, if to address soviet realia: historians still argue if the development of virgin soil in Kazakhstan was the individual strategic campaign or the cover operation to build cosmodrome, that is the element of space infrastructure.

It makes sense to subdivide infrastructure by two directions from strategizing point of view: those its types that give economics the opportunity to earn funds, and those where it is viable (necessary) to invest funds into. Still, in both cases infrastructure needs funds for its development as well as while modernization is required. For instance, according to one of the versions the center of Europe is located near the Ukrainian village of Dilove near the town of Rakhov, Zakarpatskyi region<sup>1</sup>. Such

<sup>1</sup> Geographic centre of Europe Dilove. URL: [https://ua.igotoworld.com/ua/poi\\_object/13831\\_geographical-centre-of-europe.htm](https://ua.igotoworld.com/ua/poi_object/13831_geographical-centre-of-europe.htm).

geopolitical status provides Ukraine according to first direction the component of infrastructure required to convert the national state into powerful logistic and energy operator (transitioner). Gas transportation specialization of Ukraine is well known, however, at the times of the USSR the domestic fuel and energy complex was also of significant importance for the continental energy industry. There are three energy synchronous zones on the Eurasian continent. Union of the Coordination of Transmission of Electricity (UCTE) includes energy systems of 23 continental Europe countries that are part of UCTE. Since July 2003 till February 2022 the Western Energy System of Ukraine (the so called "Burshtynska thermal plant island") was working in a synchronized manner with UCTE. The Eastern synchronous zone, OCTE, includes the countries of CIS (Commonwealth of Independent States) (excluding Turkmenistan and Armenia, energy systems of which function in parallel with Iranian one) and Baltic countries (Lithuania, Latvia, Estonia). The Northern system (NORDEL) joins the energy systems of Northern Europe countries, i.e. Sweden, Norway, Finland and the western part of Denmark.

These unions were developing independently from one another, though the links were being grown with time. The conference "The perspectives of unification "East-West"" in 2009 proved that there are no unsolvable technical and institutionally legal obstacles to create pan-European energy markets with the possibility to create the largest energy space in the whole world «with indicated power over 860 GW, which includes 12 time zones, 37 countries and about 900 million energy users. The united European space is the opportunity to increase the energy provision reliability throughout the territory along with the expanding of energy market borders and possibilities. However, it is exactly Ukrainian high tension electricity transmission ETL-750 and ETL-400, which are not active now, were to act as integrators of united Euro-Asian network and to be its transit corridor, and Poland, which is peripheric now, should have turn into the capital of common energy zone [10].

The use of non-working mines capacities could also be a prospective for energy accumulation, the creation of international energy hubs in the mining regions of Ukraine and Poland. Nevertheless, military and political situation in Ukraine and Europe makes implementation of pan-European energy space impossible for long term. Nevertheless, the synchronizing of Ukrainian and European energy networks took place, with the prospective creation of competitive and transparent electric energy market according to the requirements of European legislation and market practices [11].

According to Elon Musk version, 5 out of 11 branches of the fastest transport landlines Hyperloop could go through the territory of Ukraine, three of which cross Kyiv: the first one joins China, Europe and Canada, the second one joins Asia, Middle East, Europe

and Northern Africa, while the third one is between Spain and China. It will be possible to get to India from Kryvyi Rih or Dnipro or to America from Kharkiv, Donetsk or Odessa.

Ukraine can also be prominent as the participant of a New Silk Road project, in order to do this, an effective and transparent mechanism of customs clearance as well as high quality system of railways and automobile highways is required – the scale of Chinese investment in this strategy implementation could amount to several trillions of dollars [12].

It's significant that now discussions are being held on creation of new high-capacity portals with conveyor belts lines in the area of Ukraine-EU border crossing between Rava Russka in Lviv region and Polish town of Tomaszow-Lubelskie, which are 32 km from one another [13].

Notwithstanding the importance of transition infrastructure to Ukraine, it's worth not failing to properly evaluate the role of innovative infrastructure. According to Ukrainian Law, innovation infrastructure is a complex of enterprises, organisations, institutions and their unities, associations of any form of property that give services in the provision of innovative activities (financial, consulting, marketing, information and communication, legal, educational, etc)<sup>1</sup>. Besides, innovation ecosystems are created and developed in localization space where material, production, information and labour resources are concentrated and that allow develop and use innovative solutions, and every economy branch has specific traits of economic activities performing and innovative activity types [14].

Although, under the environment of current industrial revolution this needs more detailed description. Old industrial regions of Ukraine (Dnipropetrovsk, Donetsk, Luhansk and Zaporizhia regions) are still not using the research potential to the full range. On the background of almost 82% of low marginal steel export, the ratio of investments into highly and medium technological branches of Donetsk oblast makes only 5,4% against 9,7% in Ukraine in general [15]. If one considers startup as a sign and the fastest factor of innovation development, then the distribution of projects through the regions is significantly non-homogeneous: the largest number of them is registered in Kyivska region (almost 58% or 154 units), there's only one startup in Donetsk region (Wattagio) [16], with also two in Dnipropetrovsk and one in Zaporizhia and Kirovohrad regions each. Even though, according to the data of Startup Ranking service, Ukraine takes 42<sup>nd</sup> place among 192 world countries as for the number of startups (266 units) [17]. The most progressive Ukrainian startup sector is technological one - in 2019 p. The record breaking 544 million USD of venture investments were mobilized to this sector, the sum total of investments into Ukrainian technological companies within the period of 2014-2019 makes 1400 million USD [18], which makes Ukraine one of the most attractive countries in Eastern and Central Europe for investment.

<sup>1</sup> On innovation activity. The Law of Ukraine. URL: <https://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=40-15#Text>.

This limited number of startups in old industrial regions makes surprised those people, for example, who have very long driving experience and still remember the traditions of old Soviet "garage culture" that compensated the poor access to brand automobile service stations by the work of handy people. These craftsmen who sprang from the school extracurricular activities of technical creativity or engineering construction groups at Pioneer Clubs or military and sports preparation associations did magic of creativity and wisdom. Based on this, the knowledge about the so-called Maker Movement in the USA gives the idea of a modern examples of innovation: tech-shops have already appeared in California, Michigan and North Carolina, the movement of personal production FabLab has also increased. Tech-shop is a workshop, a shop and a club at the same time [19]. The owners of these establishment offer to their subscribers the access to various new generation industrial equipment with the overall cost of several million USD, including automatically programmed mills and tools, laser knives, etc for a decent monthly payment. There's a movement of industrial labs called Hacklab where people produce not only for themselves but also according to the other companies' orders. In other words, a new class of industrial freelancers is emerging. Within the scale of global state 3D-entrepreneurship is able to make such a giant leap of economic effectiveness based on additive production and owing to reducing of material quantity, good energy capacity, and energy and logistics spending and elimination, which was impossible to imagine even at the times of previous industrial revolutions [20]. WhatsApp messenger that is now used by over one billion of people all over the world and was sold to Facebook for 22 billion USD in 2014 was created by Mr. Ian Borysovykh Kum who was born in Ukraine (now American citizen).

The world is loaded with funds during the epoch of industrial revolutions. The owners take funds from old branches and are trying to use capital in a more profitable way. Innovation infrastructure, like transport and energy ones, should become a way to use this financial flow to invest it in industry development infrastructure and through it into society as a whole, to increase labour efficiency, its intellectual level creation of decent conditions and security and by this increasing the life quality of people at enterprises, environment protection and rational use of natural and secondary resources. It will have a significant social effect apart from sufficient economic results. Thus, this has to be defined as separate and important infrastructure branches.

## 2. Social infrastructure development directions

Social infrastructure should include those its types that allow to achieve notable social results. In this way, the improvement of demographic situation in Ukraine should have its own infrastructure. The ideas to create such specific types of infrastructure are inspired by the thoughts expressed by the specialists of the Institute of Demography and Life Quality named after M. V. Ptukha, National Academy of Science of Ukraine.

For example, the complex approach to achieving financial self-sustainability of families with children needs the services uniting employment and parenting (affordable and high quality system of pre-school institutions, individual childcare services). The growth of orphans number requires establishment of institutions that will bring up orphans in families or in environment close to family, implementation of the mechanisms to define (and search) children who lost their parents as a result of military activities, lost children, or families in hardship, etc, it's important to adjust support mechanisms for all forms of upbringing children with no parents – foster families, patronage families, family type orphanages, guardians families or national fostering.

The special type of infrastructure should be ageing people support with promotion of active longevity, which envisages efforts to increase ability of keeping good health condition and social integration for elderly people. What sets a good example is the everyday life of people as it is organized internationally in elderly people homes that allows their keeping themselves busy. At the same time, public awareness would be of importance, based on the example of an active part of those institutions that care about sticking to healthy lifestyle since childhood, as well as awareness of negative results of unhealthy lifestyle, the vivid examples of difference in health condition between people with who cared about it since childhood and contrary ones.

Even the need to quickly increase life expectancy, especially among men requires its infrastructural support, e.g. in high quality treatment and nutrition at workplace (with employers' involvement to provide one), labour conditions control, support to working flexitime, etc. One should not forget about high quality and sufficient nutrition of people as an important component of the state food security.

The decrease of immigration expenses is also impossible without relevant infrastructure that must keep contacts with compatriots abroad (labour, educational, cultural, financial, legal), support and develop their feelings of being Ukrainians, their love to their Motherland and nuclear, "small" Motherland. Principal impossibility to ban migration causes the necessity to create mechanisms off preventing migration being one-way with no return by using potential positive effect, e.g. increase of Ukraine labour potential by using new skills and knowledge of returning migrants, as well as involving migrants' funds not only to keep their families but also for investments into economy.

Now the infrastructure is required to create workplaces for internally displaced population (IDPs) and integrate them to its maximum within the territories of their temporary residence, to create civil bodies for their uniting so that they could have the channel of self-representation and share positive experience of work and residence integration at a new place.

The lack of qualified workforce which Ukraine economy will definitely face in post-war period will require infrastructure of foreign workforce involvement based on the principles of substitutional migration. It could be rational, for example, to establish the service

of foreign students' recruitment during their studies or after they successfully graduate educational establishments in Ukraine to maximally integrate them as long-term migrants into Ukrainian society.

There's a reason to have a new and more astute approach to professional education of vocational jobs workers based on existing technical higher educational and vocational establishments, including would-be students, to stimulate their choosing engineering professions. Besides, practical training is required to educate people to get professional positions they are going to obtain after higher educational establishment graduation. To do this, universities must have closer contacts with enterprises and production businesses that are virtually the ones searching for young specialists. The experience of some technical universities as for apprenticeship of their students in production is also worth attention.

It is logical, with the aim of ordering and professions effectiveness improvement, to differentiate awarding qualifications and academic degrees for scientists, education professionals and the ones employed in production and management according to their place of work, i.e. for scientific institutions (scientific degrees should remain), educational establishments (PhD, or PhD in education with obtaining their degree in higher educational establishment with the emphasis upon scientific economic and organisational

issues of educational process, using scientific results in education and, if wish be – scientific degrees), in business and production (management, MBA, with degrees obtaining in scientific or educational establishments).

### 3. Conclusions and recommendations

The analysis of publications and practical situation gave the chance to realise that strategic studies of post-war Ukraine recovery lack to a certain degree an important formula constituent that would give more impression not only about essence but also about the ultimate result of the programme product. This insufficient awareness of [Ukrainian society as per the choice of strategic development way leads to a certain unclearness of priorities. However, everything aforementioned about the infrastructure under current conditions give all the grounds to considering in to be one of the basic constituents for the formula of further state national economy and its social sphere development.

Therefore, infrastructure's nomenclature is worth preparation and development followed by continuous monitoring of every direction activities, correlation of achievement with world practices, actions to achieve results, relevant investment, including international projects with taking into consideration their sequence and terms of implementation. So, consequently, one of strategic slogan for post-war recovery of our state must be "Future Ukraine is at the first-place infrastructure of social life and production at the European level".

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**Амоса О. І., Амоса О. О. Проблеми повоєнного відновлення та розбудови інфраструктури України**

У статті звертається увага на відсутність ключової формули у стратегічному плануванні для розробки програм відновлення. Тому розглянуто можливість інфраструктурної трансформації як ключової складової формули відбудови економіки. Проаналізована роль інфраструктури в умовах війни та після неї. Наголошується на важливості інфраструктури для відновлення економіки, соціальної сфери та національної безпеки з урахуванням великих втрат у різних сферах, таких як житло, транспорт, промисловість, освіта, охорона здоров'я та інші. Показано, що розробка ефективних програм відновлення, з акцентом на інфраструктуру, має вирішальне значення. Остаточні рішення слід ґрунтувати на ретельному аналізі, оцінці впливу та чіткому стратегічному плануванні з урахуванням історичного досвіду.

*Ключові слова:* інфраструктура, національна економіка, виробнича та соціальна сфери, повоєнне відновлення, енергетика.

**Amosha O., Amosha O. Problems of Post-War Restoration and Development of Infrastructure in Ukraine**

The article draws attention to the lack of a key formula in strategic planning for the development of recovery programs. Therefore, the possibility of infrastructure transformation as a key component of the formula for economic recovery is considered. The role of infrastructure in the conditions of war and after it is analyzed. The importance of infrastructure for economic recovery, social sphere and national security is emphasized, taking into account large losses in various areas, such as housing, transport, industry, education, health and others. Developing effective recovery programs with a focus on infrastructure has been shown to be crucial. Final decisions should be based on careful analysis, impact assessment, and clear strategic planning based on historical experience.

*Keywords:* infrastructure, national economy, industrial and social spheres, post-war reconstruction, energy.

