

MODERNIZATION AS KEY DEVELOPMENT TOOL AND SAFEGUARD AGAINST RISKS ASSOCIATED WITH RAPID INNOVATIVE PROGRESS

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***Abstract.** The article reviews modernization at an angle of the need to ensure that any technological advancement in the economic sphere should be focused on as well as guarantee beneficial effects for the population as the key fundamental priority of the revolutionary technological transformations taking place at present. The effect of widespread robotization coupled with extensive efforts to advance artificial intelligence may inevitably lead to replacement of human labour which phenomenon should be "cushioned" by effective modernizational policies and efforts through efficient integration and adaptation of innovative technologies primarily for the benefit of the improved well-being of the people.*

Modernization is explained from various aspects of economic development; its components, factors and evaluation of its progress are substantiated along with analysis of various processes taking place under the transformational-modernizational activities in the economic system. Also, modernizational potential is reviewed and detailed as a basis and foundation for successful modernizational activities' implementation.

Key words: *modernization, modernizational potential, transformations, technological advancement, economic factors, social-economic system, infrastructure.*

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At present, globalization still remains the key factor of the world economic development even despite recent tendencies of protectionism and in some cases attempts to isolate national economies from extraneous influences and risks. Increasing inter-dependence of world economies both industrially and financially brings about new interpretations of the key economic development trends and objectives, sets about new strategies and playbooks with the purpose of finding one's way to be successful in the ever growing competitive environment. In this regard, the notion of modernization which is traditionally construed as the qualitative change or development of the entire social-economic system of a country (or region) taking effect under the influence of innovations' generation and diffusion processes in various spheres should inevitably be added with the important component of "safeguard capability" serving as a protection against the negative outcomes of rapid technological transformations.

Most notably, modernization as a space- and time-related process of self-development of the social-economic system characterized by cyclical phases and based on available local development resources should be used to guarantee balanced development of the entire economic system through effective combination of technological advancement, on one hand, and respective accommodation or reinvention [1] of the human labour, skills and expertise, on the other, to respond to the new challenges of the scientific-technical progress. (As a practical example, further pervasive spread of the driverless technology may inevitably result in making the profession of a driver redundant as happened, for instance, with the profession of a hunter which was still in high demand less than a century ago).

The dawning era of artificial intelligence will undoubtedly bring sea changes in both the way we tackle economic problems as well as in the need for humans to re-adjust to new realities of the labour market. As scientific thought predicts, the pressing need for humans to reinvent themselves in the face of the era of robots, in order to remain competitive and efficient, will grow and persist, so perhaps it is the right time to already dwell on a sort of protective mechanisms which would guarantee support for human labour when a choice is made between a human worker or a machine. Obviously, this is just a sketchy prediction of the risks the exponentially progressive technological advance will bring, but it is quite clear that similar challenges will be faced in all economic sectors, including

production, services and trade.

To support this approach, it is also worth mentioning a military sector where intense debate is currently underway on introducing a set of adequate limitations for killing machines in the battlefield. Therefore, quite serious attention now deserves a perception that modernization, which is clearly the instrument of human beings to successfully implement technological achievements, should as well encompass a sort of "checks and balances" mechanism to make sure that technological progress brings more benefit than sacrifices and downsides to the development of the socio-economic system. This mechanism should be granted further elaboration and significantly more comprehensive consideration, while the starting point for this discourse could be the introduction of something like a "human labour factor" where labour efficiency, for instance, shall not be simply judged by the performance results on the same job by a human worker or robot, but also must take into consideration the fundamental premise that any technological advance should ultimately be focused on bringing social benefit.

In general, it is recognized that modernization is aimed at improvement of an entity, and if such entity presents a part of the economic system then such improvement should result in increased production efficiency. In this respect, modernization is naturally interconnected with innovative activities which allows to use the following principle - innovative development is the basis of economic modernization. So, modernization envisages advancement of technologies, creation of institutional pre-conditions for innovative-technological development of a country, thus making this notion quite multi-faceted.

Modernization helps the system to achieve its new potential form, for instance in the technological sphere it means higher technological development stages, in the social sphere - post-industrial and network society, in cognitive aspect - informational society. It also helps reach increased level of efficiency and competitiveness of the social-economic system in general, and thus should not be merely narrowed down to simple introduction of innovations in a specific sphere and within a limited area. Broadly, modernization is a spatial process encompassing the entire social-economic area, which is though more relevant for the so-called "centers" of innovation generation and absorption; on the other hand, peripheral areas absorb innovations at a much later stage based on their capabilities to accommodate such innovations. Therefore, in spatial terms modernization presents waves (or stages) pervading specific social-economic areas of a country or region when each and every level of such pervasion (macro-, mezo-, and micro-level) goes through its modernizational or innovative stage at a specific period in time.

Levels of modernization in the ideal uniform social-economic space of the "locked" social-economic system with unhindered dissemination of information and energy and no extraneous influences present a pyramid-like structure from the centre to periphery (*Figure 1*, line A).

Such scheme can be called ideal distribution, however in reality any space has different extents of density, permeability, number of available communication channels which result in the waves spreading inconsistently and being distorted by the space (line B). Moreover, there are no locked social-economic systems per se, and therefore the distribution of the waves in developed countries demonstrates more steeper angle corresponding to the higher level of advance technological systems compared to the developing countries where such distribution has more of a flat-like course. The movement of waves in the centre and periphery will also have very different character, as the waves in the center would be more regular and uniform, although this does not rule out possible large crises. Then, middle periphery is characterized by significant process variations in time with less regularity compared to the centre, while the ultimate periphery, due to the "scaling down" of innovations, will have more flat-line like indicators of development with visible shift to the right and considerably lesser in value.

With a large number of approaches existing toward definition of modernization there are two aspects generally recognized as the most important ones in the process of realizing modernizational principles, namely: scientific substantiation of the proposed actions, and innovative direction of such actions. As a result, modernization is often regarded as the ability of modern people to scientifically direct changes in the society [2], and as such it must be closely related to the process of transformation which essentially translates into conversion of one economic system into another accompanied by the dying out of old elements, traits and properties that are ultimately

replaced by new ones. Profound modernization can bring about transformations resulting in new properties in the modernized system, and this practically allows to declare that the new system has actually arisen. In turn, transformation of the system may be associated with modernizing such elements of the old system which are required to be preserved in the new system as a result of necessary adjustments required by the new operational conditions.

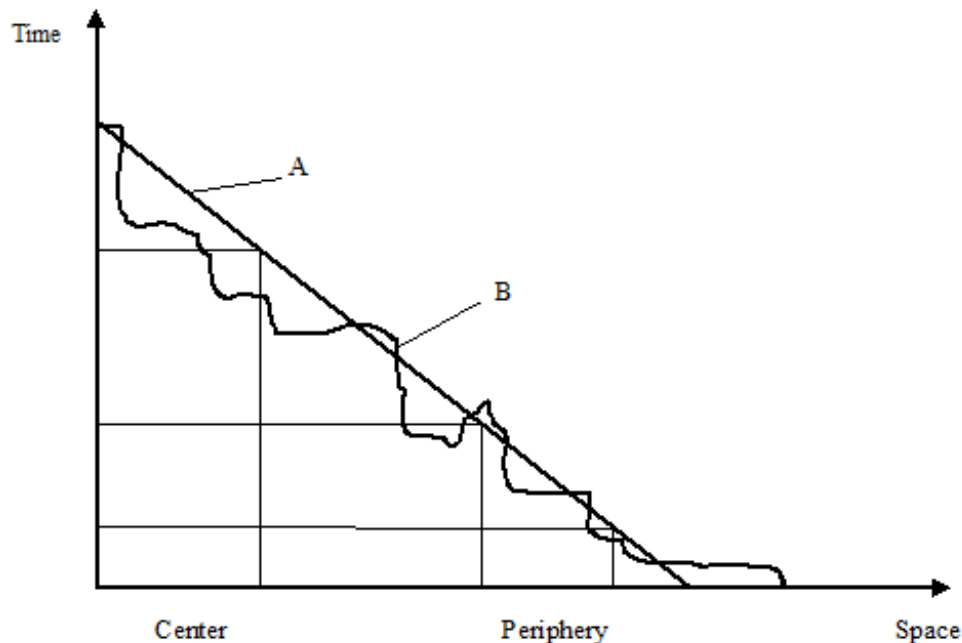


Figure 1: Modernizational waves.

Obviously, modernization introduces improvements which should completely correspond to the requirements of modern time, and in this sense it means improvement of various processes: reformation, reconstruction, restructuring, reorganization, reinvestment, etc. For instance, modernization as a qualitative change aimed at increasing the efficiency and innovativeness of management techniques becomes a sub-structure of reformation that generally reflects a reaction to the crisis of the existing management system and aims to stabilize parameters of functioning of a regional social-economic system. Modernizational reformation therefore becomes a long-term process with the purpose of ensuring compliance of the economy with the dynamically changing outward environment.

Yet, transformational-modernizational processes present not only changes of qualitative parameters of the economic system, with gradual transition toward the new quality, but also reinvention of functions and substance of specific spheres as well as optimization of conditions of such changes on the basis of modernizational activities. It is therefore the process of development, improvement and accumulation of positive changes as well as creation of necessary conditions for continued modernization for the next periods of development. Also, modernizational activities reflect the process of partial or full renewal and thus become one of key directions of strengthening intensive development and growth of economic efficiency. To summarize this, it can be said that modernization is a process of reinvention, structural shifts, and renewal occurring within the economic system on the basis of intensified investment-innovative activities.

Effective modernizational efforts directly depend on proper evaluation of modernizational potential, which essentially encompasses investment and innovative potentials. Investment potential means provision of necessary capital with the purpose of its further increase as well as investment capabilities to pursue, support or preserve some processes. It is also an accumulation of resources which allows capitalization of labour and enables economic entities to operate available resources, provide stable economic revenue and increase labour efficiency. In turn, innovation potential presents

a component of investment space which includes target functionalities as the combination of scientific-technical, production-social, financial-economic and cultural-educational capabilities required to efficiently implement innovative and transformational-modernizational development of a country and its regions.

Innovative and modernizational activities share similar functional objective as they are both aimed at revitalizing key spheres of economic activities and territorial-production complexes, yet they bear some differences in their nature. The basis for innovative activities lies in the improvement of production processes through development and implementation of new or significantly improved products as relates to their properties or methods of usage. Thus, in the center of innovative activities sit the scientific-technical research efforts which are systemic by nature and based on existing knowledge obtained as practical experience, and aimed at creation of new materials, products, processes, devices, services, systems or techniques. The very purpose of such activities is to ensure considerable improvement of already existing entities and systems. Modernizational activities, on the other hand, primarily relate to comprehensive transformation and reconstruction on the basis of new progressive advancement of the structure, substance, organization and management in key spheres of activities in response to the challenges of modern times. So produced and created products become not only partially improved but assume entirely new character as they are obtained on the principles of a completely new knowledge-based economy.

Based on such approaches, the modernizational potential can be generally explained as the combination of prospective and already mobilized resources used to provide structural reinvention of production processes in key spheres of economic activities combined with coordinated operation of its key components, namely: scientific, organizational, informational, labour, technical and technological. All these components should be integrated into a well-coordinated structure which would ultimately provide the basis for the formation of a new innovative development model with the purpose of ensuring increased economic competitiveness and improved well-being of the people.

Key elements of the modernizational potential can be presented in the following diagram (Figure 2):

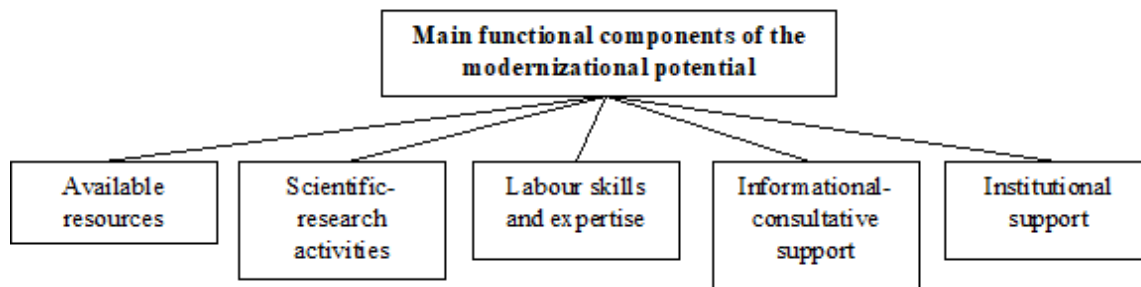


Figure 2: Structure of the modernizational potential.

Modernization also heralds new stages of economic reforms in a country and forms a basis for establishment of the new innovative model of development aimed at increased economic competitiveness and improved well-being of the population. It becomes a leading force in the context of formation of the new world architectural model of the digital economy with the network infrastructure arising as its key element that enables efficient response to the global social, ecological and technological challenges. Technological innovations under modernizational activities inevitably bring about new ideas and realities (big data, artificial intelligence (AI), quantum technologies, virtual and augmented reality, e-trade and e-currencies, etc.) as well as create new products: AI, machine learning, blockchain and cloud technologies, etc. Institutional base for such technological innovations includes crowd-funding services, mutual crediting platforms, online banking, e-currencies, mobile payment systems, forex, digital data exchange platforms, high-frequency trading, e-trading and many others, while efficient digital data processing makes it possible not only to predict the consumer behaviour, but also build new business models which eventually transform entire markets. Such

innovations lead to a much tighter mutual dependence between the progress of digital technologies and their efficient usage in various spheres of economy which thus requires establishment of highly innovative digital sectors as well as re-invention of digital innovative capabilities of all existing economic spheres.

Modernization with internal evolutionary parameters is usually called organic, and such organic modernization is usually taking place in countries-leaders. On the other hand, others simply have to follow the leader with their modernization processes stimulated exclusively by extraneous factors. Obviously, multi-faceted nature of innovations creates multi-directional modernizational trends as well as multitude of guiding principles. In order to examine the very essence of modernizational processes and specific features of its realization they should be broken down into two interconnected domains: substance and internal processes. From the point of view of the substance, modernization can be presented as a desire to bring economic development closer to some kind of ideal state through implementation of improvements required by modern realities in the world. Thus, modernizational paradigm can be determined as the research of problems and consistencies of development as well as efforts to use pre-conditions regarding establishment of a more competitive and efficient operational regime for the economy by transforming its main institutions and technological level. Dissemination of innovative practices and introduction of the new forms of integration of economic spheres should ensure transition of the economy to a new higher functional level.

Resulting from the modernizational processes would always be the preservation by the economy of key structural properties, followed by acquiring of new properties primarily through the transformation of ties between the sub-systems and components. Overlap and gradual replacement of the existing system will occur with the main purpose of transforming functional model into non-linear one and sectoral structure into the network one. Upon such a replacement a diversification will be observed in interaction of the properties of components which will result in mutual offsetting, mutual enhancement or modification with the radically new system coming into being and inheriting both novelty and preserved old features.

Innovative vector of modernizational processes within the economic system is based on internal structural creation and practical implementation of technological and institutional novelties, and therefore revolutionary changes will ensue in technological systems and social-economic institutions as a result of innovative modernization which is truly characteristic of the modern global technical-economic development. On the other hand, the "catch-up" or "follow-up" models enable only selection and adaptation of leading advance technological and institutional practices which had already proven their efficiency within other systems. However, such models are not limited to mere imitation, because the adequate adaptation of such novelties requires unique efforts together with coordinated efforts on their successful implementation aimed at ensuring they compliance with the specific features of a host-system.

Differences in the development stimulus also become very distinctive. The innovative progressive social-economic model is characterized by an almost exhausted potential which pressingly requires evolutionary changes as well as transition to a new stage of development. On the other hand, in the "catch-up" system the main stimulus would be the desire to preserve and maintain the integrity of the existing system in the face of increasing extraneous challenges and problems resulting from the lost momentum in technical-economic advancement as well as ever deteriorating adaptive capabilities. With all this, it has to be noted that the key driving force (social subjects) of any modernizational change almost always presents an internal structural phenomenon.

Based on the existing methodological approaches toward the formation, development and functioning of the regional economic systems the following set of factors seems relevant to better evaluate trends in modernizational advancement which can be essentially grouped into the following clusters: natural resources, economic, social-demographic, scientific-technological, and infrastructural which have both endogenous and exogenous character. The main components of the structure of available potential, based on key factors of its development, should therefore include three fundamental elements: basic, modernizational and labour (*Figure 3*).

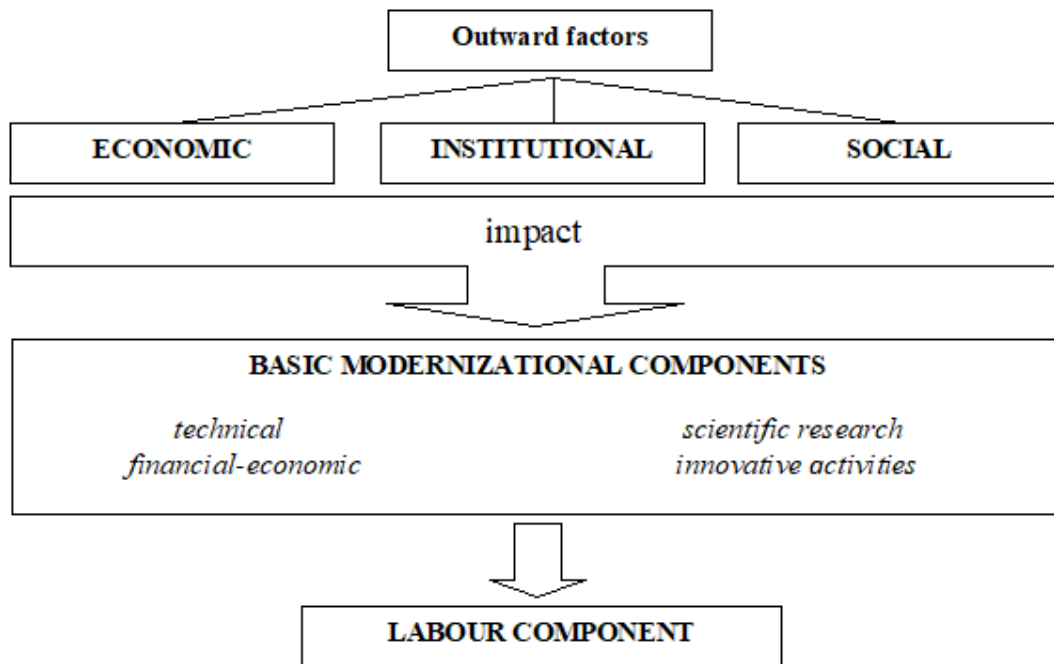


Figure 3: Modernizational potential development factors.

Presented structure of the modernizational potential factors allows to analyze not only its targeted results (as cumulative resources) but also the character of such factors' usage (increase and development of resource potential of an economic system in terms of both quality and quantity) through involvement of additional resources (enhancement of basic component) as well as improvement of efficiency of their usage (development of modernizational component).

While structuring the modernizational processes it is important to determine the following parameters: purpose and key objectives of the process; mechanisms that will ensure formation, realization and regulation of the modernizational activities; methodological approaches toward evaluation (gauging) of pre-conditions for implementation as well as the extent of goals' achievement in modernizing economic activities. Determining the extent of necessity as well as directions and models of economic modernization on the basis of identifying their development character and specifics will require the assessment of the existing potential as well as growth capabilities inherent to the regional social-economic systems along with the comparative analysis to determine the role of each and every region based on indicators of economic performance.

Systemic evaluation of the transformational-modernizational development can be determined and presented by the calculation of a respective generalized integral index based on key components of the modernizational potential. Such index will serve as a comprehensive multi-faceted indicator encompassing five main elements of the modernizational potential which reflect specific stages of transformation and modernization of the economy, namely: efficiency of the processes related to investment, innovative, scientific-technical, personnel-intellectual and institutional activities. This approach will allow to realistically determine effectiveness of the transformational-modernizational processes with the purpose of making right managerial decisions.

The important indicator for the development and functioning of the modernizational potential will therefore be its cumulative efficiency that can be presented in a broadly used general formula for efficiency criteria:

$$R_{ef} = \frac{W}{Z} \rightarrow \max ,$$

where: R_{ef} is efficiency criterion; W – size of the ultimate positive effect; and Z – total expenses.

Further, the modernizational development efficiency ratio can be determined as a correlation between volumes of realized modernizational products and total amount of modernizational expenses:

$$K_{ef} = V_{in}/V_{exp} ,$$

where: K_{ef} is the ratio of efficiency; V_{in} – volume of realized innovative products; and V_{exp} – all expenditures on innovative products.

The current situation in Ukraine is characterized by the existence of considerable progressive technological ideas and achievements along with the unique scientific-production base and highly qualified personnel, however the efficient advancement is hindered by extremely low motivation for modernizational transformations resulting primarily from the "drying up" of financial sources required to pursue creation and implementation of scientific-research developments. Another challenge is the unbalanced innovation system itself doubled with low acceptability of innovations by entrepreneurial sector because of their not very high and quick profitability. In order to resolve such long-time crisis the effective modernizational policy should be introduced as a leverage to increase productivity in economic spheres of the country and its regions as well as stimulate structural revitalization of the economy.

In addition, the very recognition of the fundamental principle of modernizational processes that by being a key tool of revolutionary transformations occurring in the global economic systems it must ultimately lead to the improvement of the people's wellbeing should embed a very important "safeguard" element into any technological advancement in order to ensure universal social benefit of such new technologies' application.

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