Economic effects of non-additive development of industrial enterprises: an analytical review of the process and structural transformations

Abstract. The article presents a methodological approach to assessing the effects of non-additive development (NAD) of enterprises, which takes into account the impact of economic processes on the intensification of production activities of an enterprise and its socio-economic transformation. The author analyzed the current non-additive development of enterprises in the industrial sector of the Ukrainian economy by assessing the dynamics and identifying key trends depending on the main types of industrial activity. The results of the analysis were used to identify recent structural changes in the industrial sector.

Keywords: analysis, development, dynamics, enterprise, estimates, industry, tendency

1. Introduction

It is important in achieving Ukraine’s strategic goals its integration with developed countries with the priority of integration in foreign economic policy with European Union. A prospects for such integration are determined not only by the adaptation tools of integration interrelations of national economy in European space, but also immanence at the convergent stage of non-additive properties and vectorization of them to positive pole of the dual nature of non-adative economic system that promote integration processes.

Non-adative, as concept of economic system development, has characteristics abrupt dynamics of the processes of functioning, which is a prerequisite for non-adative qualitatively new levels of existence, determined by intangible creative
beginning. Effective management of development mechanisms highlights show the need to research of financial and integration processes that find their own reflection in the immanence of the non-adative state of industrial enterprises.

Achieving the non-adative state as a phenomenon of the new qualities system creates opportunities to overcome the crisis and their consequences under the influence of positive polarization of results of the development of processes along the trajectory innovation function in the post-crisis period. Analytical tools detection of latent manifestations of non-adative properties of development industrial enterprises is the economic and mathematical modeling of processes by using the theory of fuzzy logic and correlations of results abrupt dynamics of functioning and interaction of industrial enterprises.

The positive non-adative properties of industrial enterprises determine their innovative development. The economy efficiency of functioning industrial enterprises directly depends on the increase of latent manifestations of the complex positive non-adative properties, which is characterized interrelation of innovations and system effect, non-adative and results of the non-adative, structural integrity, value of relationships in business processes, capitalization of financial costs. Thus, the issues related to strategic economic growth and the intensification of the innovation are quite relevant for domestic industrial enterprises.

That is why issues aimed at studying the processes of the evaluation and analysis of NAD of industrial enterprises need further research and is relevant for modern companies.

2. Analysis of publications of the problem

The study of literature showed that the phenomenon of convergence is considered as a communication and integration phenomenon, the result of which are the effects that occur at the junction of industries, and there is a possibility of new properties in the system [Frooman 1999: 28-34; Chu & Brown 2020: 101-105]. Any of the economic systems that achieve the effect of convergence are characterized by effects of non-adative. Their prolongation creates a favorable environment for the non-adative of system properties that were not inherent in parts before. At the same time, non-adative characterizes a set of system properties that were not inherent in components of system as a whole and its individual elements. It is a consequence of unpredictable bifurcation [Gakhovych 2012: 95; Willson, McKey & Cooper 2020: 267-274]. That’s why achieving an non-adative effect in economic system is the easiest to explain by coordinated group activities. So, today the behavioral economics is basis for studying the non-adative properties of economic systems [Apstaine 2018: 92-93; Gregor & Tailor 2019: 112-123; Gurochkina 2020: 52-54].
In the information sources it is determined that the non-adaptive potential characterizes the probability of realization by enterprise of financial, economic and integration potentials, which exceeds the product of the probabilities of realization the component potentials [Buyak, Kulina & Pauchok 2011: 328-329; Sidorov 2018: 36-37]. A new qualities of economic system are manifested through the group activities of people, subjects of the economic relations in their social interaction, where the occurrence of unforeseen events in the economic system is attributed to the behavior of subjects [Gurochkina 2020: 62-63; Karnegy & Peterson 2020: 87-89; Kruger 2001: 312-320; Telnov 2005: 44].

The study of the behavioral aspects of economic entities in a competitive market is based on psychological factors and orderly preferences that can influence people’s decisions in various situations, changing the economic system. At the same time, more attention is paid to situations where people behave differently than predicted by classical economic theory with its assumption of rationality and selfishness [Chu & Brown 2020: 121; Kruger 2001: 355-356; Yevdokimov & Gubska 2008].

A review of the literature revealed that the solution of the interaction of technology, economy growth and social progress has an impact on the formation of management decisions on promising strategic directions of enterprise development. Such ideas create mechanisms of interaction and contribute to NAD of industrial enterprises [Karnegy & Peterson 2020: 111; Willson, McKey & Cooper 2020: 308-309].

3. The purpose of the article

It is representation the analytical review of the main economic effects of the NAD of industrial enterprises, which provides study conditions the production and economic activities and structural transformations of enterprises in Ukraine at the basis of analysis results the main dynamics and trends of it.

4. Research methodology

The duality of non-adative is determined by technological normality or inconstancy. It affects the structural transformation of economic system of the enterprise from strong and adapted to unbalance with signs of dynamic chaos. The factors influencing the activation of non-adative properties are inversely proportional to the components of the economic security system of innovation potential the industrial enterprises. It is advisable to consider activation processes in terms
of motivators and demotivates, and, at the same time, signals of the non-adaptive and the results with different poles. We take into account that the development of industrial enterprises is carried out due to the results of activation of non-adaptive properties that promote innovative transformations. The above facts indicate that results of comparative evaluation are indicators of conformity of the conclusions of model of the dynamic chaos with a dual attractor and depends on the phase portrait of the industrial enterprise. Vectorization of dynamic changes provides an opportunity to reach a stable mode of the operation of industrial enterprises. Among the other, it is planned to analyze the dynamics of industrial enterprises profitability over the past decade.

5. Presentation of the main research results

The conceptual basis of the functional dependence of the non-adaptive properties of the economic system or industrial enterprise is focused on determining the impact of the level of economic security of the system (industrial enterprise) on non-adaptive properties that set the direction of stability and balance of the economic system. The proposed dependence involves the study of key factors influencing economic security and the performance of macrofunction of the system. This approach to assessing the non-adaptive properties of the economic system outlines the boundaries of the function and sets the type of the economic growth of system.

In order to identify non-adaptive properties, we consider the main stages of formation of the scheme of non-adaptive properties. It can be used not only in the value chain in mergers and acquisitions, but also the internal mechanism of industrial enterprise.

The generalization of research the scientific sources allowed to identify the main non-adaptive properties of the first kind of functioning and transformation of an enterprise within the value chain, when systemic effects are achieved. So the center of the scheme is the system properties of bifurcation of the potential of industrial enterprise development – innovation, standardization, adaptability, environmental and economic responsibility to stakeholders, etc. The positive results of non-adaptive properties, in our opinion, are static profitability and its stability taking into account time limits, integration and competence of management, ability to accumulate maximum added value, structured organization, capitalization (transformation of income into value), scaling.

Obtained forecasting results will allow to choose the strategy of adaptation of the industrial enterprise, which will be the basis of the mechanism of development of non-adaptive properties of the enterprise. The first stage in the formation of
the concept of modeling non-adative economic systems is to identify the objects of modeling, which can be an enterprise, association, cluster, territory, region, country, international industry system. The second stage contains research on a certain non-adative state of the system and its behavior in time and economic space. To do this, we use data on economic indicators of the system development, postulates on the general behavior of the system and the interaction of its components.

The main source of innovative development of industrial enterprises and non-adative properties in an unstable environment is financial support and intensification of financial processes. A system properties of bifurcation of industrial enterprise development potential are: innovation, standardization, adaptability, social, ecological, economic responsibility to stakeholders. Positive results of non-adative properties are static profitability and its stability taking into account time limits, integration, competence of management, ability to accumulate maximum possible added value, structured organization and so on. The identification of non-adative properties of an industrial enterprise is carried out by seven groups of indicators:

1) the concentrations of profitability, which characterize the ability of an industrial enterprise to accumulate financial resources over a period of time and are determined by changes in net financial result (net profit), equity, economic value added, the net operating profit less adjusted taxes and operating income net of taxes and the interest, gross income before interest, dividends, before taxes and depreciation on fixed assets and intangible assets the earnings before interest, taxes, depreciation and amortization (“A”);

2) the level of integration that characterizes the company’s ability to be a full partner in the association and stable relationships with partners and/or stakeholders, are determined by indicators of the adaptation and ability to operate under adverse conditions, achieve the necessary standards, change business activity, liquidity and solvency, especially the indicator of payment discipline and the volume of investment and non-financial resources;

3) the balance of the structure that characterizes the integrity of the enterprise and its stability, which is manifested in unchanged strategic positions;

4) the indicators of the changes in economy effect of financial leverage and financial stability, analytical assessments of interaction with stakeholders – Nash (Nash) equilibrium, player competence (the concordance) and the expert assessments of management quality, staff satisfaction with administrative levers;

5) capacity building which characterizes strengthening of a competitiveness, effective scaling, localization of production by structural units, the changes in capitalization and market share;

6) responsibility of enterprise which characterize the balanced activity and result of which is a combination of triple effect: the economic, social and
environmental, transition to a circular economy and the tax competitiveness of enterprise. The legal and tax responsibility of company is designed to ensure transparency, honesty and the tax discipline. Introduction of a closed cycle model of production, recycling or recycling and redesign;

7) the innovation of enterprise, which is characterized by the achievement of the latest product characteristics or the introduction of process innovations in production, indicators of the level of automation, innovation activity, financial support of innovation.

A tools for activating non-adaptive properties of industrial enterprise can be application and implementation of the: certification, 5 circular business models, 6 sigmas, kanban, value stream mapping, total productive maintenance, Toyota production system, just-in-time, etc.

In our opinion, it is necessary to characterize in more detail the specified indicators of blocks of activation of the non-adaptive properties of industrial enterprise. The first group of indicators is important for identification of non-adaptive properties as it indicates effectiveness of financial resources management.

The most important indicator of this group is “A” – measure of the enterprises profit, which ignores the payment of the taxes, investment costs and debt service. The calculation of this indicator is used to assess the company’s ability to service loans. “A” began to count on the peak of the fashion of acquiring companies through debt financing – leveraged buyout and buyout of company by management buyout. It was also carried out the expense of borrowed funds. Such loans are raised to repurchase the asset and “A” allows to assess the company’s ability to service the additional burden. At the same time, it is important for both the investor, the lender, and management to assess whether long-term cash payments affected the conduct of short-term actions in the enterprise, which meant investments (when depreciation does not affect balance of money in accounts). Given this feature of “A”, it is advisable to use indicator for companies that make rare, but the large-scale investments with a long depreciation period.

So today “A” is used much more widely, as it characterizes free indicator of managerial manipulation (opposed to indicator of personnel management – a key performance indicator). Assess the development of enterprise, the inclusion of “A” indicator in main evaluation criteria is a basic novelty.

The second group includes indicators that characterize the level of involvement and integration in the joint activities of associations, clusters, strategic partnerships and which characterize the company’s ability to be a full partner.

A method of determining indicators of results of the integration industrial enterprises involves the calculation of indicators for groups: the change in business activity; liquidity and solvency; business process assessment; payment discipline; adaptation of enterprise and, at the end, achievement of high standards and norms. In each group there are many coefficients, the set of which
allows to identify non-adative changes in integration of industrial enterprises into a single whole.

The basis of trust between partners is not only rhythmic interaction or the adaptation to the new rules of business between partners, but payment discipline. It is purchasing discipline – timely and accurate fulfillment by individuals and a legal entities of obligations to creditors and the others to pay money, including taxes to state and municipal budgets. Sometimes it is compliance with the forms and procedure of payments established by law, the other legal acts and agreements. It follows from this definition that payment discipline depends directly on the parties to transaction: sales, deliveries, commissions, etc. The payment discipline in industrial enterprise characterizes the timeliness and transparency of financial payments for obligations in full and just in time.

The third group consists of indicators that characterize the balance of interests and rights of enterprise, their stable activities in the process of joining forces, creating clusters and strategic partnerships.

The concordance coefficient, which characterizes the quality of the examination at the value of the indicator “0” indicates the inconsistency of the opinions of experts, at the value of the indicator “1” – the characterizes complete unanimity in the conclusions.

According to Nash’s balance in the strategic interaction of two or more players, the participants anticipate the actions of rivals and implement their actions according to optimal development strategy. Feature is the interdependence of changes in this set of strategies. The individual players can not increase winnings by changing the choice of strategy unilaterally, as changes must also occur in strategic directions of the other participants in the game. Nash equilibrium – directions of strategic interaction [Sidorov 2018: 54-55]:

**Hypothesis A.** If there is an equilibrium in dominant strategies, it is Nash equilibrium.

**Hypothesis B.** If none of the strategies included in Nash equilibrium, it can be rejected when removing strongly dominated strategies. Theorems allow us to apply the procedure of removing the dominant strategies before finding Nash equilibrium.

**Hypothesis C.** If mixed extension of any game with finite number of strategies, there is always Nash equilibrium for mixed strategies.

Thus, Nash’s equilibrium is a stable social agreement that characterizes the consistent rational actions of participants in decision of the game. That is why, to identify non-adative properties of enterprise, strategic irrational actions can be obtained by inverse induction and are called equilibria of empty threats (contrary to the assumption of rationality of players).

The fourth group includes indicators that characterize strengthening of the potential of industrial enterprise. It determined by indices of the competitiveness, scaling and localization, changes in capitalization and market share.
A capitalization involves the transformation of income into value. Peculiarity of the method is that the object of evaluation under study must have a stable income or a stable rate of change. Depending on the purposes of the valuation, the following indicators may be taken into account for income: profit before tax, net profit or free cash-flow. It is the total amount of net cash flows as a result of operating and investing activities, excluding financial activities, as the latter takes into account payment of dividends, return of investors’ contributions. Free cash-flow is indicator that characterizes the amount of cash flow that investors can claim. The method of income capitalization provides for the use of the gross net approaches, respectively entity (gross value – based on total capital) and equity (net value – on equity).

Under the net approach, the value of enterprise is defined as the ratio of net profit to capitalization rate; under the gross approach, the value of enterprise is set as the difference between share from the division of profits to payment of interest on the weighted average cost of capital and the amount of borrowed capital.

The business scaling and economies of scale have undeniable advantages or positive effects. It is manifested in a decrease in average costs compared to an increase in production in the long run. The negative effect of scale include an increase in production costs (average costs) with increasing production of industrial products. In the model, when costs are divided into fixed and variable, the positive effect of scale is described by reducing the value of fixed costs per unit of output while maintaining the same number of variable costs while increasing the number of products.

The fifth group includes indicators that characterize the implementation of corporate social responsibility and determined indicators of social, environmental, economic effects and indicators of closed cycle production.

The construction, implementation and use of a circular model of production allow for economic assessment of amount the raw materials. At the same time it’s calculated as the sum of volume extraction / production and the import of resources, excluding volume of exports. Accordingly, it looks like (1):

\[ \rho = \sigma_v - \varsigma_v + \tau_v, \]  

where:
\[ \rho \] – the general economic and mathematical form of a circular model of production;
\[ \sigma \] – the domestic production of raw materials, monetary units (m.u.);
\[ \varsigma \] – the export of raw materials, m.u.;
\[ \tau \] – the import of raw materials, m.u.;
\[ \nu \] – the raw materials that have been removed from the environment and physically entered the production cycle for further processing or consumption, m.u.
Integration processes give rise to global problems that require a concerted effort. Thus, for the International Organization for Standardization (ISO), the main issue is to achieve well-being of society through the model of “sustainable development”.

A corporate responsibility is characterized by balanced activities, which is result in a combination of significant benefits, introduction of closed production, resource conservation models and tax discipline, it prevents the concealment of income of formally owned entities with low tax rates in offshore areas. The basis of tax discipline and the deoffshorization nature of behavior the economic entities is study theory of transfer pricing, controlled transactions and key principles of international cooperation. In our opinion, higher levels of legal and tax liability, activation of non-adaptive properties of thee system at micro level, as business leaders make management decisions that contribute to non-adative industrial development.

Process of redistribution of financial resources in tax planning system of multinational companies is gradually becoming more complicated. In the overall set of foreign economic cooperation of economic entities, the focus is on transfer pricing. To financially stabilize and ensure the transparency of doing business, the implementation of action plan in Ukraine has been introduced. Compliance with rules and regulations of tax law on the erosion of tax base between countries and redistribution of profits between related companies is basis for quality tax planning and timely adaptation of international business to tax innovations. The corporate social responsibility is designed to ensure the sustainable development of industrial enterprise throughout its life cycle.

The strategy for the smart, sustainable and inclusive growth, provides implementation of the next priorities [Frooman 1999: 29]: a reasonable economic growth based on knowledge and innovation; the sustainable growth (it is promote more resource-efficient and competitive economy; a comprehensive growth provides high employment in terms of territorial unity.

The main reasons that motivate companies pay special attention to the issues of social responsibility are: the globalization and associated intensification of competition, growe size and influence of companies, etc. [Melashich & Starinets 2017: 259-262].

A corporate social responsibility is a concept in which companies integrate social and environmental issues into their business and the stakeholder engagement on a voluntary basis [Gurochkina 2020: 189]. The corporate social responsibility, as a balanced activity that results in combination of triple effect, social and environmental, is characterized by transparent and ethical behavior that promotes sustainable development, namely as: promotes health and well-being of the society, meets stakeholder expectations and current legislation and international standards of conduct. Thus, the corporate social responsibility of the
organization is a strategy of doing business to create public goods, which allows you to get the other useful effects. On the positive side, corporation’s socially responsible behavior improves the brand’s reputation, reduces risks, hinders staff turnover and increases staff productivity, and strengthens the trust of both the consumer. The development of corporate social responsibility policy at domestic enterprises is gradually becoming more popular.

The evaluation of the activation of non-adative properties at the micro level leads to a comprehensive diagnosis between elements of economy systems and interaction of industrial enterprise with stakeholders.

So scientific and innovative potential is characterized by removal of obsolete facilities and the introduction into production of new science-intensive technologies, creation a new industries for in-depth processing and manufacturing of high quality end products (including on the basis of points “growth”). It is as well as the ability to achieve high-tech status in world markets for such products and to resist threats in field of science, technology and innovation. Such potentials types of industrial enterprise are important for activating and applaying a non-adative properties.

The main task of structural restructuring domestic industrial enterprises involves the innovative basis. It is the removal of obsolete capacity and the introduction of new high-tech technologies, the creation of new productions for in-depth processing and production of high quality final industrial products, the energy efficiency and the intensification of energy saving policy production models. Implementation of these measures will be able to create multiplier effect for the entire economy of Ukraine, giving it a strong innovative impetus and helping to strengthen economic security.

In general, the non-adative state of system is evaluated as a set of properties that it can have only, if the integration of certain components and their interaction with each other. The peculiarity of a non-adative is unpredictable behavior and activity of such elements (financial, innovative, integration, social, environmental, etc.).

The non-adative is manifested through the factors of interaction and effectiveness of system in a certain the composition of active ingredients. Achieving qualitative changes in the system is called “non-adative”. Quantitative changes, – a “results”, – identify the indicators of development at micro level, which are determined by algebraic addition of original elements. As usually, countries with growing economy, that are on path from the group of developing countries to the group of developed, are called non-adative. However, a transition and abrupt path of sustainable, innovative development can be recurrent as this property is fundamental to dissipative dynamical systems.

Thus, assessment of the activation of non-adative properties at micro level leads to a comprehensive diagnosis and monitoring of elements and interac-
tion of industrial enterprise with stakeholders. Processes of the mergers and acquisitions of industrial enterprises occupy a larger share in formation of gross domestic product not only in industrialized countries, but also in countries with non-adative economies.

In our days industry is one of the strategic components of the country’s economy. The current state of functioning in Ukrainian industry, its financial support and development are quite complex, as it is due to a number of problems. But, despite the availability of social and intellectual potentials, low competitiveness, import dependence and raw material orientation, lack of financial resources and significant public debt weigh on the mechanisms of industrial development. Therefore, determining the role of industry in Ukraine economy of and its main drivers of activation non-adative properties in instability, which can significantly improve the situation of Ukrainian industrial producers, is extremely important to ensure the positive effects of non-adative situation.

Examining the volume of financial support for development of industrial enterprises in the non-adative economy, we should pay attention to the stability of the national currency and indices of industrial production. According to State Statistics Service of Ukraine (SU) [State Statistics Committee of Ukraine 2020], the dynamics of exchange rate indicates next gradual depreciation the national currency: UAH exchange rate vs. USD in 2020 amounted to 23.68, compared to 2007 (5.05 UAH), which is 18.2 UAH more than 3.6 in times.

The indicators of dynamics the inflation indices characterized by constant fluctuations. At the same time, in 2012 there was a deflation of 99.8% in Ukraine, which is characterized lower prices on goods and services, reduced business activity. However, significant inflation is observed in 2015 to 143.3%. It should be noted that during this period of time there was no significant impact on industry. In 2016 the trend of the industrial production index changed – in 2016 it amounted to 103.1%, when in previous years it was below the threshold value. As of 2020, due to deterioration of performance in industry, there was a decline in the industrial production index to 9%. This is 91.6% compared to previous 2019. There is no doubt that the devaluation of the national currency is one of the factors influencing the index of investment attractiveness. This means that the Ukrainian labor potential has become more than 3 in times “cheaper”, accessible to the foreign investors. Under such conditions, the economic interests are leveled. Investigating the financial and integration mechanisms of industrial development, in non-adative economy there is an expediency to consider indices of industrial production by type of activity.

In 2014-2019 fluctuations of the industrial production indices by types of activity were recorded [State Statistics Committee of Ukraine 2020]. Thus, for example, in 2016-2018 there was a positive trend of growth the indicators and in 2019 there was a decrease in the volume index which is 99.5%. The volume
of industrial production is decreasing, which is a negative trend. Instead, the values of the indicator of the volume of sold industrial products until 2018 had growing dynamics. But, unfortunately, in 2019 sales slowed down and showed a decrease of 2.78 mill. UAH.

The realization of Ukraine’s industrial potential since 2014 has had a positive growing dynamics, but in 2019 it showed a decline. The dynamics slowed down to 1.1% compared to 2018. Inflation indices are characterized by constant fluctuations: in 2012, deflation of 99.8% was observed in Ukraine. It was characterized by lower prices for goods and services and business activity. A significant inflation was observed in 2015 to 143.3%. It should be noted that during this period it did not have a significant impact on industry. In 2016, the trend of the dynamics of the industrial production index changed – it amounted to 103.1%, when all previous years it was below the threshold value. As of 2020, due to the deterioration of results in industry, there was a decline in the industrial production index to 9%, which was 91.6% compared to 2019. The main reasons for the decrease in sales of industrial products or the actual realization of Ukraine’s industrial potential competition in the markets and the non-competitiveness of the innovative potential of the industrial producer, which is associated with insufficient financial support for innovation, credit difficulties and weak opportunities to attract the foreign investment, due to changes in government and a political instability. In particular, for the first time in the history of the independent Ukrainian state in 2018, a mono-majority was elected in Ukraine. Accordingly, such changes had consequences, given that the most people did not have sufficient experience in public finance management, fuel, energy, science, medicine and the other sectors of the national economy. After five years of growth, industrial production decreased to 1.8%, including electricity, gas and steam supply decreased to 4.1%, and in the processing industry – to 2%. Production volumes in the mining industry have not changed, in the processing industry in 2019, the positive dynamics of indicators is observed in high-tech industries, such as: pharmaceutical (growth of 5.1%), production of computers, electronic and optical products (to 4.3%), chemical (to 3.3%), production of food, beverages and tobacco and furniture, other products, repair and installation (to 0.2%).

The low level of innovative potential of industrial production begins with significant losses of previous periods of business partners in the other economic activities, as industry is one of first to form value chains. As a result, it is inextricably linked to integration business processes. So, according to SU [State Statistics Committee of Ukraine 2020], the number of industrial enterprises implementing innovations is constantly changing. The record was 16.6% in 2016, in 2017 there was a decrease to 14.3%, in 2018 it was 15.6%, and the lowest is in 2005. Therefore, the main reason for industry failures is the mismatch the level of innovation potential of the Ukrainian industrial producer to world standards
and a consistently low share of innovation-active enterprises, at the same time, with significant debt burdens on both the state budget and industrial production.

Today the dynamics of the indicators of financing the innovative activity of industrial enterprises today remains in a larger volume – it is the own working capital of enterprises and organizations. The expenditures for implementation of innovative activities of the industrial enterprises of Ukraine increased rapidly in 2016 and amounted to a record 2.32 mill. UAH, which is almost twice less than in 2018 – 12.18 mill. UAH. This gave a high indicator of the results of the introduction of innovative technologies and innovations with a value of 16.6% in 2016 (according to SU [State Statistics Committee of Ukraine 2020], 3489 units of the new technological processes were introduced).

The largest part in the structure of financing belongs to funds from own sources of industrial enterprises, in second place are the other sources and in third – the state budget and non-resident investors. The largest amount of funds allocated from the state budget in 2018 amounted to 6.39 bill. UAH, in 2019 – 5.56 bill. UAH. It should be noted that the trend of financing Ukrainian industry from non-resident investors changed in 2014, when there was a sharp decline in foreign support for domestic innovation.

In addition to the lack of financial security, morally and physically obsolete equipment (70%) national industrial products do not fully meet the requirements of the world market, namely: quality, environmental performance and high level of resource consumption (material and energy consumption), which negatively affects profitability industrial enterprises.

The precondition for the such problems is insufficient innovation activity of industrial enterprises, low level of innovation, in fact, use of waste-free and low-waste, energy-efficient and resource-saving technologies is not ensured, closed production cycle and non production technologies are not implemented in the country. According to the official data of SU [State Statistics Committee of Ukraine 2020], following key trends and problems can be identified. Thus, the number of industrial enterprises implementing innovations during the study period is constantly fluctuating with a record 16.6% in 2013. In 2017, there was a decrease in the indicator; its value was 14.3%, later in 2018 – 15.6%. At the same time, there is a constant fluctuation of values, but there is no significant increase. The main indicator of the number of innovatively active enterprises in the total number of industrial enterprises is also growing: in 2016 – 18.9% and then again there is a decrease to 16.4% in 2018.

Examining indicators of the number of innovation-active enterprises in Ukraine that try to use the innovative model of development, it should be noted that their successes are insignificant. Despite fact that Ukraine has a sufficient number of scientific staff and relevant potential, there is not enough experience in creating and implementing an innovative product. The reasons for the negative
The net profit of the industrial enterprises in 2010-2018 has an unstable dynamics. According to SU [State Statistics Committee of Ukraine 2020], we observe after a significant loss in 2014 (–178.73 mill. UAH), in 2015 (–188.26 mill. UAH), in 2016 (–247.24 mill. UAH) there was a rapid improvement indicators of profitability the industrial enterprises in 2017 (–56.12 mill. UAH) and in 2018 (–109.28 mill. UAH). In this case, we assume the presence of non-adative properties in industrial enterprises of Ukraine, as significant wave-like dynamics of the net profit indicates non-adative development, which is characterized by a long interval, with insufficient funding and uncompetitive industrial products.

All this indicates certain irrationality in management, as reducing the volume of sales and financing increases net profit of industrial enterprises in 2017-2018 maximum allowable threshold values of constant fluctuations in the economic dynamics of industrial enterprises.

Net profits of mining and quarrying enterprises for the period 2010-2018 were abrupt. The significant deterioration of the situation in 2014-2015 is primarily due to changes in the market of industrial products. For example, there was a change in the target orientation to ensure the interests of European and Asian industries, creating new value-added industrial chains. At the initial stage of military aggression in eastern Ukraine, the national industry was in a state of the considerable turbulence. The government has made a logical decision to sever trade and economic ties with Russia Federation, which has significantly affected the financial and economic performance of industrial enterprises.

In 2015, the indicator of net profit from a negative value (–23.12 mill. UAH) changed to 18.02 mill. UAH in 2016. An absolute amount of deviation the indicator in 2016, compared to 2015, amounted to 41.1 mill. UAH (177.96%), and in 2017 to (–41.8 mill. UAH), compared to 2016, which is 231.98% increase. In order to restore the profitable activities of industrial enterprises, a set of business relations is gradually being established to interact with the new partners and markets for the sale and marketing of industrial products are being mastered. In the mining industry, such a strategy is easily implemented, as products are minerals: coal, gas, ore, stone, sand, clay etc. They have a stable demand not only in the domestic market, but also abroad. The most popular today are minerals extracted, both open and underground (gypsum, anhydrite and limestone). The net profit of manufacturing enterprises has a similar pace of the development: for the period in 2010-2018 the dynamics is abrupt. However, unlike mining, the manufacturing industry must ensure the competitiveness to
ensure profitability, enhancing its economic potential by deep processing to concentrate value added.

The dynamics did not recover after the crisis period and remains negative, in terms of financial results, the most industrial enterprises remain unprofitable. The largest share of the unprofitable industrial enterprises remains in the water supply, sewerage, waste management. In order to increase profitability and the level of economic efficiency, which is relevant for the industry of Ukraine, there is concept of a circular economy. The official information from SU [State Statistics Committee of Ukraine 2020] shows, that in terms of waste recycling over the past eight years, Ukrainian realities of development of a circular economy for waste I-III hazards from economic activities of enterprises have had little success. According to various data on waste of hazard classes’ I-IV, taking into account the waste generated in households, the general indicators reach the volumes of landfills from 4% to 7% of the country.

Over the last decade, the profitability of industrial enterprises has been characterized by a wavy nature. Over the past two years, net income has begun to grow through mining and quarrying, somewhat outpaced by manufacturing. However, other types of industrial activity remain unprofitable, which has an extremely negative impact on the development of industry as a whole.

Changes in the foreign economic activity of the country had a significant impact on the financial and economic results of industrial enterprises. To prevent significant indicators of unprofitability of the industrial enterprises, it is extremely important to implement foreign experience in the implementation of a concession agreements and innovations of low-waste technologies, energy efficiency and the resource conservation, with the introduction of closed production cycles.

In Ukraine, the dynamics of waste management is unstable; the analysis of SU [State Statistics Committee of Ukraine 2020] includes data on disposal, incineration and the disposal in specially designated areas, but only a small proportion is recyclable.

Regarding the indicators of the total amount of waste accumulated during the entire period of operation, in specially designated places (I-IV-th hazard classes), it should be noted that the volume in 2010 was 13.26 mill. tons. In 2010 this indicator decreased to –0.3 mill. tons (–2.22%) and in 2018 (–0.12 mill. tons). Regarding the dynamics of indicators the waste management of economic activities, enterprises pollute the environment less for households. Thus, in 2010 the amount of waste amounted to 16236 tons, and in 2018 was (–0.12 mill. tons), which is less to 0.4 mill. tons or (–24.8%). This indicates a trend of decreasing waste in enterprises, compared to the households over the last eight years. Therefore, we shall dwell in more detail on the main reasons for this.

Analysis of the dynamics of registered business entities in the economy of Ukraine in 2012-2018 shows an increase in their number during this period of
time. Thus, during 2012-2015, there was an increase in the number of registered entities from 1.6 mill. units in 2012 to 1.97 mill. units in 2015 (23.42%). Despite the negative dynamics of the number of registered business entities in 2016-2017, when there was a decrease in their number to 1.86 mill. units in 2016 and up to 1.87 mill. units in 2017. But in 2018 there was an increase in the number of registered business entities to 1.93 mill. units. By the way, their number increased to 14.97%, compared to 2012. Regarding the number of economically active enterprises in Ukraine, the number of economically active enterprises in 2018, compared to 2012, increased from 622 538 to 666 986 units (7.14%).

In 2018, the dynamics of innovation implementation in industrial enterprises allows us to conclude that innovative development is carried out at an extensive pace, as the share of enterprises that implemented innovations in total number of industrial enterprises was 15.6%. And the share of sold innovative products in the total volume of sold products of industrial enterprises amounted to 0.8%. All this with the introduction into production of innovative products in the amount of 3843 units. This is an extremely low rate of innovation in industrial enterprises. Compared to 2000, only 15% of all industrial enterprises introduced innovations, which made it possible to introduce 15 323 units into production of innovative products and result was the share of sold innovative products of 9.4%. Latter significantly exceeds figure of 0.8% in 2018. At the same time, given that the number of active enterprises is growing at low rates of innovation processes and technological innovations in industrial enterprises, we can say that industrial enterprises, especially processing, are much more inclined and have greater potential to implement the circular economy model.

The trend of reducing waste may be associated with intensification of the introduction of the circular economy. Regarding the partial utilization of waste, there is an increase in the secondary use of blast furnace slag, steelmaking and a ferroalloy production. But, despite this, the problem still remains acute [Gakhovych 2012: 96; Gurochkina 2020: 222].

Analyzing the indicators of waste management in structure of their generation (hazard I-IV), without taking into account total amount of the waste accumulated during operation, in specially designated areas, we can conclude that disposal is only a third of waste generation, more the halves are simply removed to specially designated areas. It should be noted that only in 2010 the total value of utilization of waste in specially designated places in the structure of indicators of their generation was 113.57% and waste management exceeded their generation to 13.57%. This means that 13.57% was processed from the volume of savings for previous years. After all this part is not transported to specially designated places. A residual difference between the generation and the total value of waste management is accumulated in the annual indicators of loading of specially designated places for waste, which pollutes the environment.
The most of the waste is taken to landfills, after which probability of their recycling is significantly reduced due to existing problem of lack of proper sorting and separation of the required amount of raw materials for further processing. Therefore, the important and main task of structural restructuring of industrial enterprises on an innovative basis is the removal of obsolete capacity, introduction of the new science-intensive technologies, a productions for in-depth processing and production of high quality final industrial products, energy efficiency and energy saving policy in industry production models.

Return to the official data of SU [State Statistics Committee of Ukraine 2020], the volume of waste generation by types of economic activity and households in 2010-2018 over the last eight years decreased to 70 216 tons. In 2018 it increased to 0.35 mill. tons, compared since 2010, when 0.42 mill. tons of waste were generated, which is to 16.62% less. The most waste is generated by following groups: mining and quarrying, which are generated during the excavation work in the process of creating mines and quarries; wastes from coal beneficiation processed at concentrators and briquette factories. In the second place – processing industry with 31 522 tons in 2018. So, in our opinion, it should be noted a significant reduction waste generation in 2018 to 33.88%, compared to 2010. Significantly reduced waste generation in the other economic activities in 2018 to 69.74%, compared to 2010.

According to the results of industrial enterprises, waste was generated in 2018, 0.339 mill. tons per year, while most of them belongs to companies in mining industry. In 2016 the rate of formation was much lower than in 2018. It is primarily due to reduction in production, which affected the reduction of the net profit of industrial enterprises in 2016. Regarding the treatment of household, similar waste that generated in Ukraine in process of human life and activity are not used at the place of accumulation, it should be noted that they collect twice as much as they remove.

To the results of comparative dynamics of waste generation, it is determined that there is a tendency to exceed the waste generation over in three times. This characterizes Ukrainian production as “dirty”, as multi-waste with significant indicators of resource consumption. In order to prevent pollution and strengthen environmental protection, it is extremely important to move to the circular type of production. So such decision supply minimizing waste through innovative processes, products that should ensure and strengthen competitiveness of industrial enterprises. In order to ensure better policy of environmental protection and the management of household and similar waste in Ukraine, it is extremely important to financially support the processes of utilization and implementation of waste-free production or the circular economy.

The current expenditures and the capital investments for protection are quite important indicators of the effectiveness of environmental protection. Thus, as we
can see during 2010-2016, the volume of capital investments increased, catching up with the value of current costs of the environmental protection. However, in 2016 there was a significant reduction and the figure decreased to 10.07 mill. UAH with the current expenditures of 24.31 mill. UAH. They were covered by the public funds and international donors. The main barriers to innovative development in state are the lack of financial support for research, development institutions from the state and lack of a strong enough base of institutions that control the rational use of innovative capital of enterprises.

Current costs, capital investments in waste management are important indicators of the effectiveness of waste management policy. As for the waste management, in percentage terms there is even larger gap between the indicators of current expenditures and capital investments in the waste management (more current expenditures to 8 in times). According to the various estimates, today the need (difference between current expenditures and capital investments in the waste management) is 76.48 mill. UAH, the average value of capital investment required for development of the circular economy was calculated in range of 3% of the gross domestic product. There is a widespread opinion among experts about extremely unsatisfactory state of the national economy. This was due to a shortage of funds not only in industrial enterprises, but in the state as a whole. There have been repeated proposals to comprehensively modernize industry, to improve the business climate and ensure sustainable economic growth, etc. But all of the “effective” reforms lead to deterioration of economy due to the incompleteness.

6. Conclusion

Today, the industry of Ukraine is in difficult operating conditions due to low financial security of innovation activity. It is associated with a low level of investment attractiveness. The negative trend is exacerbated by instability of the economic situation, national currency and raiding, which are the main prerequisites for reducing investment flows. The depreciation of the national currency is the factors influencing on the index of investment attractiveness, as the labor potential of domestic industrial enterprises has depreciated more than three in times and has become more accessible to foreign investors. Under such conditions, the economic interests of society are leveled. National industrial products don’t fully meet the requirements of the world market: quality, environmental performance, high level of resource consumption (material and energy), which negatively affects the profitability of industrial enterprises.

The dynamics of investment capital revealed a decrease in level of investment activity. In the structure of direct investment in industry, the investment-attractive
processing industry remains. So, according to the dynamics of growth the direct investment by types of processing industry in terms of technological levels, a significant concentration of share capital remains at the highest technological levels, such as in the production of chemicals, pharmaceuticals and engineering. This trend confirms the priority areas for attracting investment in advanced technologies. These activities will grow rapidly, which will have a multiplier economy effect for the other industrial and economic activities.

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Ekonomiczne efekty nieaddytywnego rozwoju przedsiębiorstw przemysłowych: analityczny przegląd procesów i transformacji strukturalnych

Streszczenie. W artykule przedstawiono metodologiczne podejście do oceny efektów nieaddytywnego rozwoju przedsiębiorstwa, w którym uwzględnia się wpływ procesów ekonomicznych na aktywizację działalności produkcyjnej przedsiębiorstwa i jego transformacji ekonomiczno-społecznej. Autor przeprowadził analizę współczesnego stanu nieaddytywnego rozwoju przedsiębiorstw na przykładzie podmiotów sektora przemysłowego Ukrainy, dokonując oceny dynamiki oraz identyfikując kluczowe tendencje w funkcjonowaniu przedsiębiorstw w zależności od głównych rodzajów działalności przemysłowej. Wyniki analizy umożliwiły określenie najnowszych zmian strukturalnych w przemyśle.

Słowa kluczowe: analiza, branża, dynamika, przedsiębiorczość, rozwój, szacunki, tendencja