

Sotnyk Iryna Mykolayivna,*Doctor of Economics, Professor,**Professor of the Department of Economics and Business Administration,**Sumy State University (Sumy Ukraine);***Goncharenko Oleksii Sergiyovych,***Assistant Professor of the Department of Economics of Enterprises,**Odesa National Polytechnic University (Odesa, Ukraine)*

FORMATION OF ECOLOGY AND ECONOMIC MECHANISM OF DEMATERIALIZATION AT THE ENTERPRISE

Eco-economic mechanism of dematerialization of the enterprise (EEMDE) as an integrated system of forms, methods and incentives for the reduction of material flow management of economic entity is formed in the article. Functioning of mechanism provides dematerialization changes and solving ecological tasks, based on the economic interests of the enterprise, according to the postulates of sustainable development. The ultimate goal of EEMDE is the reduction of destructive impact of material flows of the economic entity on the environment while ensuring economic efficiency measures aimed at reduction such influence. We believe that this mechanism can be used in all areas of economic activity – from production to services provision. It allows both to compare versions of eco-efficient solutions among themselves and develop new products and business strategies taking into account the benefits of dematerialization.

Keywords: dematerialization, eco-economic mechanism, eco-economic instruments, eco-destructive influence, ecological task.

Introduction. Present requires finding new ways and approaches in solving urgent balanced social, environmental and economic problems. One of the most popular concepts, results of which are positive changes of socio-economic systems towards sustainable development is the concept of dematerialization. It lies in reduction of material flows at different levels of economic activity that is reflected in a decrease of energy and resources consumption as well as in wastes generated per unit of produced national (regional) product. At the enterprise level dematerialization is defined by gradual reduction of materials that are used for manufacturing of one unit of the end product, as well as changes in production processes that result in reduction of intermediate material inputs [9, p. 3].

In connection with the substantiation and development of the concept of dematerialization mainly in developed countries and in view of its high enough efficiency, there is a need for conduction of theoretical and applied research that will ensure the implementation of this concept in terms of Ukrainian economy. Relevance of such studies is reinforced by social, economic and environmental crisis in the country, weakening the negative effects of which can be done by enhancing dematerializational processes.

Analysis of recent researches and publications. Problems of achieving sustainable development, ecologization and dematerialization of social and economic systems are reflected in the works of local and foreign scientists. The most famous of them are L.H. Melnik [4; 12], E. Weizsäcker [7], D. Meadows [8], I.T. Penn [9], F. Schmidt-Bleek [10], K. Wernick, H. Ausubel [11], O.F. Balatskiy [12], S.K. Kharichkov [13].

At the same time, existing methodological and theoretical developments in this sphere concern mainly the macro- and meso-economic levels. Scientific and practical aspects of dematerialization processes implementation at the microeconomic level are requiring further study. In particular, relevant is formation of ecologically balanced management mechanisms

dematerialization transformations at enterprises and organizations of various spheres of economic activity, especially in crisis conditions of economic activity.

The aim of the article is theoretical and conceptual substantiation of provisions concerning formation of ecological and economic mechanism of dematerialization at the enterprise.

Main material. Ecological and economic mechanism of dematerialization at the enterprise (EEMDE) is interpreted by us as a complete system of forms, methods and incentives of material flows management that provides dematerialization and resolution of environmental problems, basing on the economic interests of the entity in accordance with the postulates of sustainable development. Formation of mentioned mechanism caused by the need of environmental pollution reduction, the production of the enterprise compliance with environmental principles, international standards, which are important in the conditions of globalization development, overcome of the current crisis and ensuring of the competitiveness of domestic products on the world market.

Ecological and economic mechanism consists of two interconnected subsystems: managing and manageable. The goal of the mechanism functioning is forming within the framework of managing subsystem, objectives of which is intending to perform achieving of goal, defining of the subject and object of management and so on. Objects, methods and management tools, stages are selected within the framework of manageable system. In the result of two subsystems interaction a synergistic affect that have to be evaluated occurs. In the case of not achieving the expected result, decisions to adjust the mechanism or search for alternative ways of ensuring are made. So, let us consider the mentioned elements of EEMDE.

Initial in the construction of any mechanism is the establishment of the purpose of its existence. In our opinion, the purpose of EEMDE should be defined as a reduction of material flows destructive impact on the environment while ensuring economic efficiency of dematerialization measures aimed at the reduction of such influence.

Any business entity as social and economic system during its operation uses a certain amount of material resources that after operational transformations (during the life cycle of products, works and services) becomes waste, emissions, discharges and damage for the environment. Concept of dematerialization at the microeconomic level and EEMDE as a tool of its implementation designed to reduce to the minimum possible (acceptable) sizes destructive impact on the environment by reducing the size of material flows at the enterprise. Positive social, economic and environmental affects which are going through the partial replacement of innovative and informative material factors of production occur in such case [1-2].

Stated objective within EEMDE requires solving the following tasks:

- to ensure compliance environmental standards at the enterprise (maximum permissible concentration (MPC) or established standards);
- reduction of the natural, ecological and resource capacity of products;
- reduction of economic expenses of the economic entity as a result of the decrease in its use of natural resources, payments for them;
- introduction of resource saving measures in the activities process of enterprise;
- stimulation of demand for eco-products that are produced by enterprise;
- ensuring of the revenue growth, acceleration of the turnover of working capital, fixed assets of the entity;
- improvement of professional skill of personnel of the enterprise and formation of ecological image of the company for consumers;
- ensuring of high benefits level to all participants of dematerialization at the enterprise;

– development of corporate environmental culture and consciousness of participants of dematerialization processes at the enterprise that reflect in recognition the responsibility for the quality of the environment by each of them and so on.

Achieving the objectives of EEMDE according to the set purpose requires the definition of the subject of management, which will be responsible for the functions of planning, organization, motivation, analysis and control dematerialization processes. The need for flexible and optimal methods of management with the increasing complexity and automation of production increases. Heads as subjects of management are increasingly have to make decisions under conditions of uncertainty, in short terms and with a lot of information. The impact of taken decisions is extremely high. So, today the functioning of the company according to the principles of sustainable development and economic efficiency is largely depends on the management of enterprise.

In accordance with the purpose and nature of EEMDE, in our point of view, the object of management can be identified as a system of interconnected material flows of the company. EEMDE construction and operation should be based on the following basic principles:

– *systematic* by which mechanism is seen as open, complex system which is characterized by dynamism, ability to self-regulation and self-development. It consists of interconnected subsystems that can cover different levels of management. Composition and place of the last in EEMDE may vary according to changes in external and internal environment conditions in which the mechanism operates;

– *flexibility* – is the high transformational ability of EEMDE to ensure its quick adaptation to the conditions of market environment that have changed in order to optimize their impact on material flows of the enterprise;

– *complexity* – provides mutually agreed development of EEMDE as a single, whole, complex of integrated management subsystems, covering all levels of management at the enterprise, stages of the life cycle of resources and products, taking into account multidirectional economic, environmental, social and other effects that arising in the process of material flows and ensure the implementation of the impact on facilities for achieving the purposes of management;

– *self-reproducibility* – consists in constant, including expanded, reproduction of motivational basis of the implementation of processes of dematerialization at the enterprise;

– *environmentally responsible* – stipulates that purpose of existence of EEMDE, decisions that are made in the framework of the mechanism, implementation tools for making dematerialization changes at the enterprise and etc. should be aimed at achieving a positive environmental effect;

– *social responsibility* – means that the implementation of any dematerialization changes should be made taking into account the interests of all concerned social groups of internal and external environment of the enterprise;

– *economic efficiency* – the process of making and implementing decisions within EEMDE should provide achievement of maximum positive economic result by an acceptable level of expenses at the enterprise.

Integral parts of the mechanism are methods and management tools that ensure the execution of required tasks. Modern scientific literature offers a toolkit of influence on the processes of ecologization, resource conservation and sustainable development, social and economic systems [4; 7-8]. Taking into account variety of administrative tools and features of dematerialization changes, in our opinion, the nature of the proposed mechanism it is the most appropriate to set tools which are developed in [3]. There are administrative units, social and psychological tools and methods and economic ones (Table 1).

Table 1 – Basic methods and instruments of EEMDE, (developed on the basis of [3])

Methods and instruments of management
1 Administrative methods
1.1 Instruments of administrative management:
– determination of the main directions and mechanisms of the implementation of enterprise policy of dematerialization;
– formation of dematerialization strategy at the enterprise taking into account social, environmental and economic factors;
– intensification of the dematerialization processes implementation;
– accounting of the impact of dematerialization processes on the state of environment;
– expert examination of material saving;
– rationing of material inputs;
– standardization of material consumption;
– ecological certification;
– audit of the efficiency of material usage (energy, environmental, etc.);
– ecological, energy passportization;
– management of material usage
1.2 Instruments of formation and development of internal economic infrastructure:
– appointment of managers on dematerialization management at the enterprises;
– formation of incentive mechanisms of stimulation of products consumption taking into environmental factors;
– attraction of outsourcing companies to implement projects of dematerialization;
– creating of the system of instructions and methodical guidances for information support, training, retraining, improvement of staff qualification;
– implementation and support of infrastructure for the usage of secondary resources at the enterprise (recirculation) and re-usage of products by consumers (network of goods renting that have been used)
1.3 Information management tools:
– introduction of new information and communication technologies;
– implementation of application software for accounting and evaluation of dematerialization;
– information databases creation
2 Social and psychological methods
2.1 Instruments of social impact:
– conduction of trainings and seminars for employees in the sphere of material conservation and environmental protection;
– creation of an appropriate level of corporate culture and consciousness in the area of dematerialization and environmental protection (corporate educational, cultural events, etc.);
– voluntary commitments to improve resource efficiency economic objects
3 Economic methods
3.1 Instruments that increase economic efficiency of the usage of production resources:
– accelerated amortization of material conservation equipment with the influence of material conservation on the environmental situation;
– acceleration of the turnover of working capital of the enterprise;
– controlling of financial and economic condition
3.2 Instruments of price formation:
– price programming (demand management programs on material resources);
– price stimulation (diversification of prices for dematerialized products, infrastructure services);
– formation of demand for dematerialized products
3.3 Financial instruments:
– staff bonuses for successes in the implementation of dematerialization;
– usage of methods of cost management;
– optimization of cash flows;
– directing of part of the profit to finance dematerialization changes;
– insurance of activity of dematerialization (types of activities, environmental and economic consequences of entrepreneurial risk);
– leasing schemes;
– performance-contracting

The main stages of implementation of the proposed EEMDE should be considered through building a logical sequence of works on dematerialization of goods (works, services).

The first stage of work in the framework of the mechanism is to form a team of performers.

For a comprehensive consideration of diverse aspects of dematerialization processes during the product life cycle it is advisable to establish a working group that includes employees of different departments of the economic entity. Due to the fact that the process of dematerialization of products can cover its production, consumption, disposal, etc. it is expected to involve experts of different profiles (engineers, technologists, economists, environmentalists, marketers, metrologists, etc.). To coordinate the work it is necessary to appoint a project manager who will direct the team to achieve the goal and to serve as a mediator between top management of the company and working group. Project manager should be present at all meetings and meetings of the working group, whose main objective is to develop, implement dematerialization project and evaluate its results. Then project manager approves calendar work schedule.

The second phase is characterized by the choice of products and identification of the services it provides. For products selection it is advisable to compare all available products that are produced by the enterprise, in terms of their environmental and economic significance for the enterprise (profitability). To determine the level of ecological compatibility of goods it is appropriate to use publicly available methods that are described in [4]. Assessment of the products profitability can be made by approaches set out in [5]. Then basing on the analysis which product of the proposed is the most suitable for starting the dematerialization process, we can choose the target product basing on its identified guidance parameters.

The third stage is the formation of describing the production process in a logic circuit. Members of the working group should reach a common holistic understanding of the process of creating products and services that it provides, building a chain circuit of all production processes that are the part of product life cycle.

On the fourth stage we conduct the assessment of dematerialization of selected products which are produced by the enterprise. Such assessment should be use scientific and methodical approach, described in detail in [6]. Essence of this approach consists in calculation of material inputs per unit of function that produced products brings in it or provide to the consumer with detailed material inputs by the stages of the product life cycle. It allows us to estimate the potential economic loss and impact on the environment of the product, which is used to provide specific services.

A content of works on the fifth stage is to determine the form of qualitative transformation of selected products. We can find new opportunities for the enterprise. The result of this stage is dematerialized product or a new additional service that reduce material component in turnover. This stage includes the following stages: identification of problem nodes; searching of possible ways of dematerialization; selection of the most realistic ideas and technologies to implement dematerialization changes; assessment of the level of dematerialization of project production; economic evaluation of effectiveness of the implementation; taking a decision to start the project implementation or to return to the previous stage; planning and implementation of the selected projects of dematerialization.

The final step of EEMDE is the assessment of actual results of dematerialization project implementation and their comparison with the expected effects: economic, environmental, social.

Schematically the main components and stages of EEMDE are depicted in Figure 1.

Conclusions and directions for futher researches. The suggested theoretical and conceptual positions allows to form ecological and economic dematerialization mechanism at the enterprise. Functioning of mechanism provides dematerialization changes and solving ecological tasks, basing on the economic interests of the enterprise, according to the postulates of sustainable development. The ultimate goal of EEMDE is the reduction of destructive impact of material flows of the economic entity on the environment while ensuring economic efficiency measures aimed at reduction such influence. We believe that this mechanism can be used in all areas of economic activity – from production to services provision. It allows both compare versions of eco-efficient solutions among themselves and develop new products and business strategies taking into account the benefits of dematerialization. As further researches, we consider actual the drafting of enterprise’s development strategy basing on dematerialization transformations, as well as searching of ecological and economic instruments of dematerialization management on meso- and macro- levels of economic activity.

1. Гончаренко А.С. Теоретические подходы к эколого-экономическому обоснованию дематериализации экономики / Ю.В. Чортюк, А.С. Гончаренко // *Внешнеэкономическая деятельность и обеспечение экономической безопасности*. – 2013. – №1(2). – С. 82-86.
2. Гончаренко А.С. Классификация энергоинформационных трансформаций экономической системы / А.С. Гончаренко // *Механізм регулювання економіки*. – 2008. – №2. – С. 208-214.
3. Механізми реалізації соціально-економічного потенціалу дематеріалізації виробництва і споживання: звіт про НДР (заключний) / Кер. : І.М. Сотник. – Суми : СумДУ, 2012. – 107 с.
4. Мельник Л.Г. Экологічна економіка : підручник / Л.Г. Мельник. – Суми : ВТД “Університетська книга”, 2006. – 348 с.
5. Економіка підприємства : підручник / за заг. ред. д-ра екон. наук, проф. Л.Г. Мельника. – Суми : Університетська книга, 2012. – 864 с.
6. Гончаренко О.С. Науково-методичний підхід до оцінки рівня екологічно спрямованої дематеріалізації соціально-економічних систем / О.С. Гончаренко // *Механізм регулювання економіки*. – 2015. – №2. – С. 11-21.
7. Weizsacker E. Factor of four. Cost – half, Return – double. New report for the Club of Rome / E. Weizsacker, E. Lovins, L. Lovins. – М. : Academia, 2000. – 400 p.
8. Медоуз Д. Пределы роста. 30 лет спустя / Д. Медоуз, Й. Рандерс ; пер. с англ. – М. : ИКЦ “Академкнига”, 2007. – 342 с.
9. Penn I.T. Web-based survey of trends in dematerialization : report № CSS01-17 [Електронний ресурс] / I.T. Penn, A. Arbor. – Center for Sustainable Systems, December 31, 2001. – Режим доступу: css.snre.umich.edu/css_doc/CSS01-17.pdf.
10. Schmidt-Bleek F. Factor 10: The future of stuff [Електронний ресурс] / F. Schmidt-Bleek. – Режим доступу : <http://epub.wupperinst.org/frontdoor/index/index/docId/4459>.
11. Wernick I.K. National material metrics for industrial ecology [Електронний ресурс] / I.K. Wernick, J. Ausubel. – Режим доступу: <http://phe.rockefeller.edu/NatMatMetIndusEcol>.
12. Балацкий О.Ф. Экономика и качество окружающей природной среды / О.Ф. Балацкий, Л.Г. Мельник, А.Ф. Яковлев ; отв. ред. О.Ф. Балацкий. – Л. : Гидрометеиздат, 1984. – 191 с.
13. Харичков С.К. Экологизация научно-технологического развития / С.К. Харичков, Ю.О. Николаев ; Нац. акад. наук Украины, Ин-т проблем рынка и экон.-экол. исслед. – Одесса : Ин-т проблем рынка и экон.-экол. исслед., 2003. – 119 с.

1. Goncharenko, A.S., & Chortok, Yu.V. (2013). Teoreticheskie podkhody k ekoloho-ekonomicheskomu obosnovaniyu dematerializatsii ekonomiki [Theoretical approaches for eco-economic justification of the dematerialization of the economy]. *Vneshneekonomicheskaya deiatelnost i*

obespechenie ekonomicheskoi bezopasnosti – Foreign economic activity and economic security, 1(2), 82-86 [in Russian].

2. Goncharenko, A.S. (2008). Klassifikatsiia enerhoinformatsionnykh transformatsyi ekonomicheskoi sistemy [Classification of energy and information transformation of the economic system]. *Mekhanizm rehuliuвання ekonomiky – Economics Regulation Mechanism, 2, 208-214 [in Russian].*

3. Sotnyk, I.M. (2012). *Mekhanizmy realizatsii sotsialno-ekonomichnoho potentsialu dematerializatsii vyrobnytstva i spozhyvannia: zvit pro NDR [Mechanisms of social and economic potential of dematerialization of production and consumption: report on research].* Sumy: SumSU [in Ukrainian].

4. Melnyk, L.H. (2006). *Ekolohichna ekonomika [Ecological economics].* Sumy: VTD “Universytetska knyha” [in Ukrainian].

5. Melnyk, L.H. (2012). *Ekonomika pidpriemstva [Economics of enterprise].* Sumy: Universytetska knyha [in Ukrainian].

6. Goncharenko, O.S. (2015). Naukovo-metodychnyi pidkhid do otsinky rivnia ekolohichno spriamovanoi dematerializatsii sotsialno-ekonomichnykh system [Scientific and methodical approach to the assessment of environmentally focused dematerialization of socio-economic systems]. *Mekhanizm rehuliuвання ekonomiky – Economics Regulation Mechanism, 2, 11-21 [in Ukrainian].*

7. Vaitszecker, E., Lovins, E., & Lovins, L. (2000). *Factor of four. Cost – half, Return – double. New report for the Club of Rome.* Moscow: Academia [in English].

8. Medouz, D., & Randers, I. (2007). *Predely rosta. 30 let spustia [Limits to growth. 30 years later].* Moscow YKTs “Akademknyha” [in Russian].

9. Penn, I.T., & Arbor, A. (n.d.). Web-based survey of trends in dematerialization. *css.snre.umich.edu*. Retrieved from css.snre.umich.edu/css_doc/CSS01-17.pdf [in English].

10. Schmidt-Bleek, F. (n.d.). Factor 10: The future of stuff. *epub.wupperinst.org*. Retrieved from <http://epub.wupperinst.org/frontdoor/index/index/docId/4459> [in English].

11. Wernick, I.K., & Ausubel, I.K. (1995). National material metrics for industrial ecology. *phe.rockefeller.edu*. Retrieved from <http://phe.rockefeller.edu/NatMatMetIndusEcol> [in English].

12. Balatskii, O.F., Melnyk, L.H., & Yakovlev, A.F. (1984). *Ekonomika i kachestvo okruzhaiushchei sredy [The economy and quality of the environment].* L.: Hidrometeoizdat [in Russian].

13. Kharichkov, S.K., & Nikolaev, Yu.O. (2003). *Ekolohizatsiia nauchno-tehnolohicheskoho razvitiia [Greening the scientific and technological development].* Odesa [in Russian].

I.M. Сотник, д-р екон. наук, професор, професор кафедри економіки та бізнес-адміністрування, Сумський державний університет (м. Суми, Україна);

О.С. Гончаренко, асистент кафедри економіки підприємств, Одеський національний політехнічний університет (м. Одеса, Україна)

Формування еколого-економічного механізму управління дематеріалізацією на підприємстві

У статті сформовано еколого-економічний механізм дематеріалізації на підприємстві як цілісну систему форм, методів і стимулів для управління скороченням матеріальних потоків суб'єкта господарювання. Функціонування механізму забезпечує дематеріалізаційні зрушення та вирішення екологічних завдань, виходячи з економічних інтересів підприємства, відповідно до постулатів сталого розвитку. Кінцевою метою ЕЕМУДП є зниження деструктивного впливу матеріальних потоків суб'єкта господарювання на довкілля при забезпеченні економічної ефективності заходів зі зниження такого впливу. На нашу думку, даний механізм може використовуватись у всіх сферах економічної діяльності – від виробництва продукції до надання послуг. Він дає можливість як порівнювати варіанти еко-ефективних рішень між собою, так і розробляти нові продукти та бізнес-стратегії з урахуванням переваг дематеріалізації.

Ключові слова: дематеріалізація, еколого-економічний механізм, еколого-економічні інструменти, екодеструктивний вплив, екологічне завдання.

І.Н. Сотник, д-р экон. наук, профессор, профессор кафедры экономики и бизнес-администрирования, Сумский государственный университет (г. Сумы, Украина);

А.С. Гончаренко, ассистент кафедры экономики предприятий, Одесский национальный политехнический университет (г. Одесса, Украина)

Формирование эколого-экономического механизма управления дематериализацией на предприятии

В статье сформирован эколого-экономический механизм дематериализации на предприятии как целостную систему форм, методов и стимулов для управления сокращением материальных потоков предприятия. Функционирование механизма обеспечивает дематериализационные сдвиги и решения экологических задач, исходя из экономических интересов предприятия в соответствии с постулатами устойчивого развития. Конечной целью ЭЭМУДП является снижение деструктивного влияния материальных потоков предприятия на окружающую среду при обеспечении экономической эффективности мероприятий по снижению такого воздействия. По нашему мнению, данный механизм может использоваться во всех сферах экономической деятельности – от производства продукции до предоставления услуг. Он дает возможность, как сравнивать варианты эко-эффективных решений между собой, так и разрабатывать новые продукты и бизнес-стратегии с учетом преимуществ дематериализации.

Ключевые слова: дематериализация, эколого-экономический механизм, эколого-экономические инструменты, экодеструктивное влияние, экологическое задание.

Отримано 05.05.2015 р.