

Forms of eco-innovation transfer in industrial enterprises

Katina Valeva¹, Valentina Alexieva-Nikolova²,

Business Faculty – University of Food Technology -Plovdiv, Bulgaria, tomika_888@yahoo.com¹
Business Faculty – University of Food Technology -Plovdiv, Bulgaria, valentina_nikolova@abv.bg²

Abstract: After the adoption of the European Green Pact aimed at achieving the sustainability of the Union's economy, industrial enterprises are faced with the challenge of creating and implementing eco-innovations aimed at achieving the goals set in the Pact. Considering that the innovation activity is a complex, expensive and risky process, for a large part of the enterprises there is the possibility of taking advantage of the possibilities of technological transfer of eco-innovations. The purpose of this report is to present the essence, characteristics and main forms of transfer of eco-innovations. The results show that the development and implementation of eco-innovations can be a complex, expensive and risky process that requires knowledge, effort and many activities that are beyond the power of every enterprise. This necessitates cooperation as a form of reducing costs and achieving a better economic effect.

Keywords: ECO-INNOVATION; TECHNOLOGY TRANSFER; GREEN ECONOMY; INDUSTRIAL ENTERPRISES

1. Introduction

In response to the challenges related to the climate and the environment, on 04.03.2020, the European Commission officially presented the European Green Pact, to achieve the sustainability of the Union economy [1]. This is the new growth strategy which aims to transform the EU into a fair and prosperous society with a modern, resource-efficient and competitive economy in which there are no net greenhouse gas emissions in 2050 and economic growth does not depend on the use of resources [2].

The strategic elements of the Green Pact are presented in fig. 1.

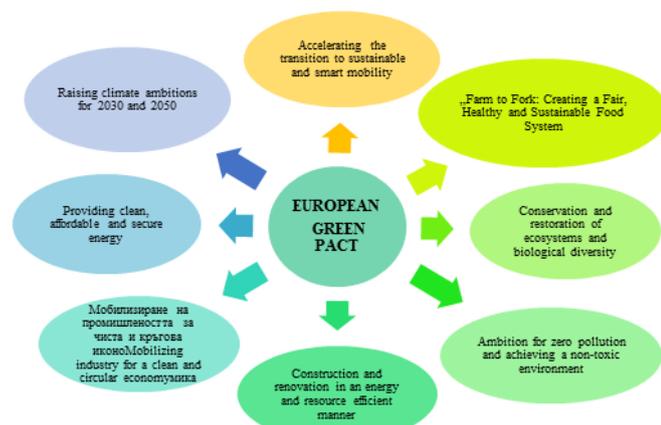


Fig. 1. Strategic elements of the European Green Pact

The conditions for achieving the goals set in the European Green Pact are:

- Provision of "green" financing and investments. The realization of the objectives defined in the European Green Deal require significant investments. According to the Commission, Achieving the current climate and energy targets for the period up to 2030 alone will require €260 billion of additional investment per year (i.e. around 1.5% of GDP in 2018) This flow of investment will need to remain constant over time. The scale of the investment challenge requires mobilizing both the public and private sectors.

- Greening of national budgets. Greater use of green budgeting tools will help redirect public investment, consumption and taxation towards environmental priorities and eliminate harmful subsidies. Mobilization of scientific research and promotion of innovation;

- Development of new technologies, sustainable solutions and revolutionary innovations. To maintain its competitive edge in cleantech, the EU needs to significantly increase the large-scale deployment of new technologies across sectors within the Single Market by building new innovative value chains [3].

- Activation of education and training. Schools, training institutions and universities are in a position to prepare students,

parents and the wider community with the changes necessary for a successful transition [4].

The concept of eco-innovation was first mentioned in the scientific literature by Fussler and James (1996). They consider eco-innovation as "new products and processes that provide value to customers and businesses but significantly reduce environmental policy"[1]. Klemmer's definition is similar, according to which: "Eco-innovations are all measures of relevant actors (firms, politicians, unions, associations, churches, private households) which develop new ideas, behavior, products and processes, apply or introduce them and which contribute to a reduction of environmental burdens or to ecologically specified sustainability targets" [2].

By achieving the main goal - reducing the harmful impact on the environment, eco-innovations make significant progress towards the realization of the sustainable development of modern society, more efficient and responsible use of natural resources and achieving economic, ecological and social impact [3].

In the nature of the innovation process lies the created as a result of creative activity products to have a practical focus and be applicable in the organization that creates them, or in the activity of another business entity [5]. Usually, the results of the research and development carried out are used to product and process development in fulfillment of the company's innovation strategy [6].

In addition, in support of long-term growth goals, they can become object of purchase and sale in the direction of companies from the same or other industries. In this case the two parties: the owner of an intellectual product and the buyer of certain rights on its use, enter into interaction within the national or the international market of scientific and technological products [7]. The process by which technology, knowledge and/or information developed into one organization, within one area or to achieve some goals assimilated and used by another organization, in another area or for the achievement of other purposes is defined as technology transfer [8].

2. Research

The implementation of the strategic elements of the European Green Pact requires the development and implementation of eco-innovations .

According to the Environmental Technology Action Plan (ETAP), eco-innovation is defined as "the production, application or operation of a good, service, production process, organizational structure or management or business method that is new to the firm or user and which leads throughout its life cycle to a reduction of environmental risk, pollution and negative impacts of resource use (including energy use) compared to the relevant alternative" [9].

The development and implementation of eco-innovations can be a complex, expensive and risky process that requires knowledge, effort and many activities that are beyond the power of every enterprise. This necessitates cooperation as a form of reducing costs and achieving a better economic effect [10].

The cooperation of organizations in modern conditions is a powerful factor for accelerating the technological level and innovation processes [11]. The need for cooperation is constantly increasing. The reasons for this are various:

- The innovation process requires large costs and there is a tendency towards their increase;
- The contraction of the market cycle of the products necessitates the need for their more frequent renewal;
- The lengthening of the cycle for the creation of new products and the complexity of the necessary research works increase the costs of implementation;
- The innovation process requires a material and information base, research and technological knowledge, current costs.

In this regard, various forms of transfer of foreign experience and technical achievements or own corporate strengths and capabilities can be used for the realization of eco-innovations [12].

- ❖ *The realization of eco-innovations with one's own forces is reduced to the implementation of the following tasks:*
 - modification of manufactured products;
 - partial improvement of the technologies used;
 - mastering the production of new products;
 - renovation of equipment;
 - introduction of innovations in marketing (market innovations);
 - introduction of innovations in management, production and labor organization;
 - legal protection of the objects of intellectual property of enterprises - inventions, utility models, industrial design, trademarks;
 - providing licenses for inventions, utility models and industrial designs owned by enterprises;
 - provision of free licenses (know-how contracts).

Each industrial enterprise forms its own eco-innovation goals – strategic, tactical or operational and builds the corresponding investment programs and projects for their realization [13]. The business plan is the main document that defines the main directions for planning alternative eco-investment projects in the enterprise's activities in the short-term and long-term perspective [14].

- ❖ *Implementation of eco-innovations through the transfer of foreign experience and technical achievements.*

The transfer of foreign expertise and technical achievements is usually seen as technology transfer or technological transfer [15]. In essence, transfer is an intermediary organizational-management activity for the selection, transfer and adaptation of scientific and applied results and new technologies from scientific structures to business organizations (vertical transfer). In practice, there is also the spread of already implemented technologies in other companies and spheres of social practice (horizontal transfer) [16]. Between the two fields (scientific and economic) there are significant substantive differences that place numerous barriers to the transfer of knowledge from one field to the other, but what they have in common is that they represent the material expression mainly of human intellectual capital [17].

The transfer of eco-innovations through foreign experience and technical achievements can take place in different forms, presented in fig. 2.

Forms of transfer of foreign experience and technical achievements of eco-innovations include:

- *Transfer of technology.* This form refers to transfer of technology in its non-materialized form through various types of contracts and agreements, contracts for "know-how", "show-how", franchising. It is applied by industrial enterprises that do not have the opportunity to carry out relevant scientific research on their own. Of particular importance is the presence of a built-up scientific and scientific-technical potential in the

enterprise to "take over" these technologies and bring them to their industrial application.

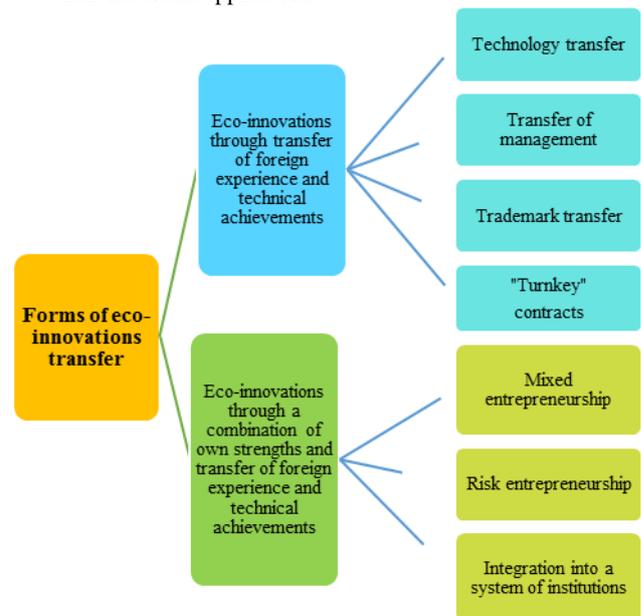


Fig. 2. Forms for the transfer of eco-innovations

- *Transfer of management.* The transfer of management is carried out through a management contract (management contract) of a national or mixed company by the foreign company (team). In some management contracts, the manager company not only manages the finances, production and marketing of the product, but also conducts the relevant administrative and personnel policy [18]. In such cases, we speak of a full management contract. In practice, there are also incomplete forms such as "consulting contracts", which can be in the field of commercial and industrial activity; on the problems of industrial production itself (industrial consultations); on engineering and technical issues (engineering consultations); on the organization of the placement (marketing consultations), on management issues (managerial consultations)[19].
- *Transfer of trademark.* The trademark recognized by the buyer is associated with quality, secured markets, strict compliance with company standards and efficient control over the entire technological process [20]. The transfer of a trademark can be carried out in two ways:
 - By concluding a franchise agreement;
 - Through its direct purchase.

"Branded" franchising means that the franchisor company provides the franchisor person not only with the right to manufacture by using the trademark, but at the same time provides the company's "know-how" and experience, company culture and strategy, quality control methods and company management [21].

- *Turnkey contracts.* Turnkey contracts are a non-equity form of investment that allows the national production base to be expanded and renewed entirely through foreign capital [22]. After the construction of the sites, they become the full property of the local contractor. The foreign contractor company usually undertakes all types of engineering-consultative services (choice of the optimal project or the design itself), performs the full cycle of construction and installation works, supplies and adjusts the equipment, prepares it for operation and makes the trial run of the production facilities [23]. After handing over the object to the local contractor, the foreign contractor bears no responsibility for the further work of the object, which necessitates that turnkey contracts be supplemented by other types of contracts. It should be noted that the imposition of additional conditions

during the construction of "turnkey" objects significantly increases their value, and this may create additional financial difficulties for the contracting authority.

The forms of transfer of eco-innovations through a combination of own forces with the transfer of foreign experience and technical achievements refer to:

- *Mixed entrepreneurship.* This is the most common form. In practice, it manifests itself in the creation of joint ventures (Joint Ventures) between two or more countries. In developing countries, the creation of joint ventures is encouraged, as through them not only investments can be attracted, but also access to new technology, management, etc. It is done through:
 - license agreement between the patent, license, trademark owner company and the buyer company;
 - union of two or more enterprises to build a structure for joint research, most often of an applied nature.

Common forms are – joint (mixed) enterprises, inclusion in a subcontractor chain, trade in knowledge-absorbing products, operational leasing, limited venture capital investment, engineering, joint scientific and technical research by two or more companies [24].

- *Venture entrepreneurship.* As a form of investment, it appears in practice in the form of special companies of the so-called. "venture" capital (venture capital firm). It is also found in the literature as an "associated" form of capital investment. The purpose of venture entrepreneurship is to invest in industries and industries where venture innovation and even scientific research are carried out. They mainly deal with risky productions. This form is specific, it has some features of the shareholder form, but differs in the distribution of the profit, with the largest share of the profit going to the shareholder with the smallest capital share. In this method of profit sharing, the large "associate" participants in the form of financial institutions pay the risk to the founders of the venture capital firm, since they risk their entire fortune. The associated form of capital investment in venture entrepreneurship can grow into a traditional shareholder form in the event that the venture (venture) is successful.

- *Transfer of eco-innovations through integration into a system of institutions.* The connection between scientific research, training and business is achieved through various forms on the basis of two-element and three-element integration. A wide variety of connections between science, education and production shows that innovation is the basis of progress, and enterprises more quickly and easily deal with emerging crises and achieve better results when science, education and production are chained together in international, national and regional aspect.

3. Methods, research and discussions

The methods used to achieve the objectives of the study are as follows: methods of description, comparison, analysis and synthesis, method of grouping, tabular and a graphic method, a survey method.

Main sources of information are statistics published by National Statistic institute (NSI); European and national strategic documents; analytical materials of The European Commission and the World Bank; research and development of scientific institutions; results of a survey carried out in industrial enterprises of the territory of the Republic of Bulgaria. Industrial enterprises from the sectors of the economy requiring the transfer of eco-innovations are summarized in fig. 3. Sectors requiring the transfer of eco-innovations for transformation include energy, construction, sustainable transport and water, waste and land management. The eco-innovations implemented can be seen in the start-up industries of renewable energy sources such as solar, wind and geothermal energy. These renewable energies can be used to support green buildings and sustainable transport to make them more efficient and greener. Water and waste management is carried out through eco-innovations related to water purification and recycling. Land management in the green economy can be transformed through

green innovation for habitat restoration, national parks, nature reserves and forest restoration efforts, etc. A study of the investments made by the country's industrial enterprises in eco-innovations related to environmental protection and restoration in the period 2010-2021 is presented in fig. 4.



Fig. 3. Sectors for transformation through eco-innovation
Source: Own calculations

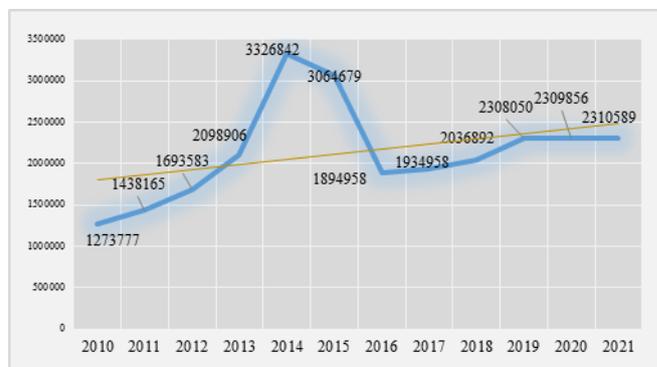


Fig.4. Changes in the total costs in the country for environmental protection and restoration , Source: Own calculations

The trend shows an increase in spending, as by 2022, it represents 1.9% of the total gross domestic product.

The distribution of the available long-lasting material assets with ecological purpose by ecological directions in the country by 2022 is presented in Fig. 5.

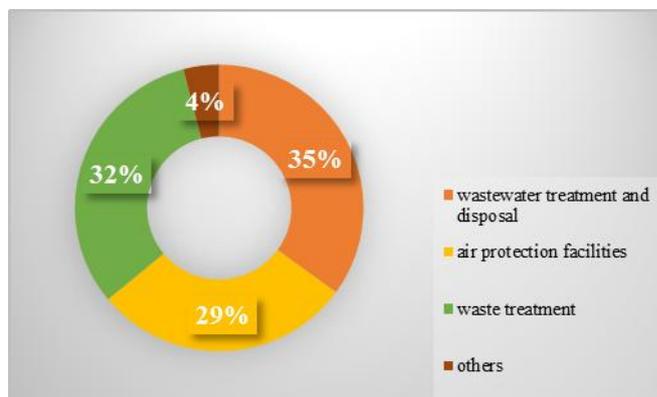


Fig.5. Investments in DMA for eco-innovations by directions
Source: Own calculations

The largest share is occupied by investments for DMA in the waste water direction (35%), followed by investments for DMA in the direction of waste treatment (32%) and investments in DMA for air protection (29%).

In fig. 6, in a percentage ratio, are summarized the costs of industrial enterprises for the transfer of eco-innovations in separate ecological directions in Bulgaria in the period 2010-2021.

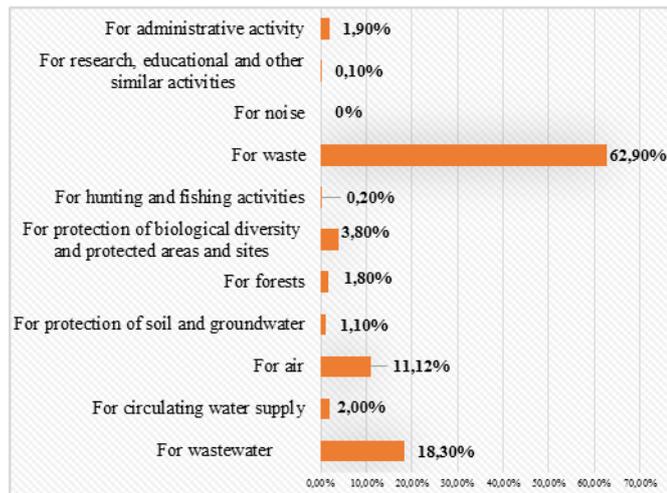


Fig. 6. Costs for the transfer of eco-innovations in eco-directions in Bulgaria for the period 2010-2021 (in %)

Source: NSI, own calculations

The data show that the largest investments of industrial enterprises for the considered period are related to eco-projects in the field of waste management (63.2%), soil protection (18.3%), water (18.3%), the air (11.7%). The least investments have been made in noise reduction, forest protection, and biodiversity in protected territories and areas. The low share of investments in research and development activity means that Bulgarian industrial enterprises rely mainly on the transfer of eco-innovations.

4. Conclusion

Innovations are of vital importance for the success of industrial enterprises in Bulgaria. Businesses need not only product or process innovation, but also innovation in the way business is run, building partnerships, winning over consumers and ensuring sustainable development. It is not enough to use innovation only to develop a new product or reduce production costs, it is necessary to apply new methods to gain prestige and trust of society. For the purposes of research, the theoretical statements related to innovation activity and efficiency have been examined. Definitions of eco-innovations have been studied and a connection between eco-innovation activity and the increase in the efficiency of industrial enterprises has been substantiated. In this context, the present work considers eco-innovation activity as a means of increasing the efficiency, competitiveness, innovation and adaptability of enterprises. Bulgarian industrial enterprises still lack the entrepreneurial innovation culture and the understanding that it is necessary to invest in human capital, which is key to the creation of R&D and the increase of economic results and efficiency. It is necessary to invest in technological development and concentrate efforts in R&D to achieve higher eco-innovation activity, efficiency and competitiveness. The main goal has been achieved, namely – to examine the state of the eco-innovation activity of industrial enterprises and how it affects the efficiency of their activity and technological transfer in the conditions of a turbulent business environment and transit to a circular economy.

This report is funded from the Science Fund of the University of Food Technology – Plovdiv, contract No 15/21-H “Innovation as a strategic factor for entrepreneurial activity in the green economy”

References:

- [1] Fussler, C. & James, P. (1996). *Driving Eco-Innovation*. London: Pitman Publishing. IES Institute for environment and Sustainability. (2009). ILCD supporting tools. Retrieved from <http://lct.jrc.ec.europa.eu/assessment/tools>
- [2] Klemmer Lehr U. and K. Lobbe, (1999) “Environmental Innovation. In: Rennings, K., (2000). *Redefining innovation — ecoinnovation research and the contribution from ecological economics.* Ecological Economics, 32, pp.319-332
- [3] Kemp R. and T. Foxon, (2007) “MEI project about measuring eco-innovation,” Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006) - Project No: 044513, Brussel
- [4] Ahmedova, S., *Technology transfer as a factor in improving the competitiveness of industrial enterprises*, 2020 IOP Conf. Ser.: Mater. Sci. Eng. 971 052033
- [5] Ivanova, V., Ivanov, O., Ivanova, O. (2021). Development of approaches to organization of innovation transfer and intellectual property management to ensure competitiveness of enterprises. *Eastern-European Journal of Enterprise Technologies*, 6 (13 (114)), 94–105. doi: <https://doi.org/10.15587/1729-4061.2021.249165>
- [6] Abdurazzakov O., Illés B. Cs., Jafarov N., Aliyev K., *The impact of technology transfer on innovation*, polish journal of management studies, 2020 Vol.21 No.2, DOI: 10.17512/pjms.2020.21.2.01
- [7] Velev, M., S. Valeva, *Study of the Impact of Innovation Capacity Factors on the Activation of Company’s Innovation Activity*, *Economic Alternatives*, 2019, Issue 4, pp. 560-570, DOI: <https://doi.org/10.37075/EA.2019.4.05>
- [8] Mom, T. J. M., Oshri, I., & Volberda, H. W. (2012). The skills base of technology transfer professionals. *Technology Analysis & Strategic Management*, 24, 871–891
- [9] Gigova, T., Nikolova-Alexieva, V., Valeva, K. (2019), *Application of Business Crisis Forecasting Models in Bulgaria*, IOP Conference Series: Materials Science and Engineering, 618(1), 012071
- [10] Nikolova-Alexieva, V., Krasteva, I., (2019), *Diffusion of innovation in the Bulgarian dairy industry*; IOP Conference Series: Materials Science and Engineering, 878(1), 012071
- [11] Mihova, T.B., Nikolova-Alexieva, V.N. (2020), *Business communities - A factor of industry and bioeconomy development*, IOP Conference Series: Materials Science and Engineering, 878(1), 012070
- [12] Nikolova-Alexieva, V.; Alexieva, I.; Valeva, K.; Petrova, M. *Model of the Factors Affecting the Eco-Innovation Activity of Bulgarian Industrial Enterprises*. *Risks* 2022, 10, 178. <https://doi.org/10.3390/risks10090178>
- [13] León- Bravo, V., A. Moretto, R. Cagliano, F. Caniato, (2019), “Innovation for sustainable development in the food industry: Retro and forward-looking innovation approaches to improve quality and healthiness”, *Corporate Social Responsibility & Environmental Management*, pp.26
- [14] Nikolova-Alexieva V., Valeva K., (2022), *Barriers to the implementation of reengineering integrated system in the industrial sectors of the bio economy*, International Scientific Conference “A multidisciplinary approach to ensure the normal functioning of health and community systems in pandemic waves”, June 22-24, 2022, Starozagorski mineral baths - Trakya Journal
- [15] Reisman, A. (2005). *Transfer of Technologies: A cross-disciplinary taxonomy*. *Omega*, the International Journal of Management Science, 33, 189–202
- [16] Markov K., (2014) “Transformation of the control activity in the administrative system”, Ed. “Avangrad Prima” C, pp.56-58
- [17] Neutzling, D.M., A. Land, S. Seuring, L.F.M. (2018). “Do Nascimento, Linking sustainability-oriented innovation to supply chain relationship integration”, *Journal of Cleaner Production*, pp.172
- [18] Parthibaraj, C.S., N. Subramanian, P.L.K. Palaniappan, K.-H. Lai, (2018). “Sustainable decision model for liner shipping industry”, *Computers and Operations Research*, pp.89
- [19] Ramanathan, R., B. Poomkaew, P. Nath, (2014). “The impact of organizational pressures on environmental performance of firms”, *Business Ethics*, pp.23
- [20] Andersen M. M., (2008). “Eco-innovation towards a taxonomy and a theory,” in DRUID Conference Entrepreneurship and Innovation
- [21] Keeble J., D. Lyon, D. Vassallo, G. Hedstrom, and H. Sanchez, (2005), “Innovation High Ground: How Leading Companies are Using Sustainability-Driven Innovation to Win Tomorrow’s Customers”. Arthur D. Little
- [22] European Commission, “Competitiveness and Innovation Framework Programme”; <http://ec.europa.eu/environment/etap/files/guidelineinn.pdf>
- [23] Eco-innovation Observatory, <http://www.ecoinnovation.eu>
- [24] Kemp R. and T. Foxon, (2007) “MEI project about measuring eco-innovation,” Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006) - Project No: 044513, Brussel