KNOWLEDGE – International Journal
Vol. 23.4
Budva, Montenegro, May, 2018

INDUSTRIAL ECOLOGY FROM THE GREEN FINANCING AND ECOLOGICAL COSTS ACCOUNTING ASPECT

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Abstract: The problem of protecting and preserving the environment requires a systematic approach that can only be provided by a complete review and problem identification. The development of industrial ecology is an attempt to provide a new conceptual framework for understanding the impact of industrial systems and processes on the environment. This new framework is used for identification, and then implementation of the strategies to reduce the impact on the environment of products and processes which are associated with industrial systems with the ultimate goal of sustainable development.Considering the major consequences of environmental degradation globally, its protection represents a very important scope of research. Accordingly, the aim of the paper is to highlight the importance of applying green financing and the most appropriate methods for calculating environmental costs in achieving the goals of industrial ecology. Green financing is a new area of financing, that has application in the process of integration of environmental protection and economic profit. The term includes a wide range of environmentally friendly technologies, projects and industries. Essentially, green financing is part of the green carbon because it connect financial industry, environmental improvement and economic growth, which is essential form for long-term Sustainable Development.Integration of ecological aspect of business into traditional activities of a company requires revision of existing and developing of a new model of costs calculation. Consequently, increasing the level of general costs in the structure of total costs and their distribution onto activities, processesor products which they caused, provoke developing of use of specific methodologies which are suitable for covering and measuring of ecological costs and benefits.
Keywords: Industrial ecology, Green financing, Environmental costs, Sustainable economic development

INDUSTRIJSKA EKOLOGIJA SA ASPEKTA ZELENOG FINANSIRANJA I OBRAČUNA EKOLOŠKIH TROŠKOVA

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Rezime: Problem zaštite i očuvanja životne sredine zahteva sistemski pristup koji jedino može da se obezbedi uz kompletan pregled kao i identifikaciju problema. Razvoj industrijske ekologije je pokušaj pružanja novog konceptualnog okvira za razumevanje uticaja industrijskih sistema i procesa na životnu sredinu. Taj novi okvir služi identifikaciji, a potom implementaciji strategija za redukovanje uticaja koji na okolinu imaju proizvodi i procesi povezani s industrijskim sistemima s krajnjim ciljem održivog razvoja. Obzirom na velike posledice degradacije životne sredine na globalnom nivou, njena zaštita predstavlja vrlo važan opseg istraživanja U skladu sa tim, cilj rada je da ukaže na značaj primene zelenog finansiranja i najprikladnijih metoda obračuna ekoloških troškova u ostvarenju ciljeva industrijske ekologije. Zeleno finansiranje je nova oblast finansija koji ima svoju primenu u procesu integracije zaštite životne sredine i ekonomskog profita. Sam izraz, opisuje širok spektar smernica za ekološki orijentisane tehnologije, projekte i industrije. Suštinski, zeleno finansiranje povezuje finansijsku industriju, poboljšanje životne sredine i ekonomski rast, što je od suštinskog značaja za dugoročni održvi razvoj.Integrisanje ekološkog aspekta poslovanja u tradicionalne aktivnosti preduzeća zahteva preispitivanje postojećih i razvijanje novih modela za obračun troškova. Shodno tome, povećanje nivoa opštih troškova u strukturi ukupnih troškova i njihovo raspoređivanje na aktivnosti, procese ili proizvode koji su izazvali, podstakli su razvijanje i primenu specifičnih metodologija koje su pogodne za obuhvatanje i merenje ekoloških troškova i koristi.
Ključne reči: Industrijska ekologija, Zeleno finansiranje, Ekološki troškovi, Održivi ekonomski razvoj

INTRODUCTION

Increasingly noticable problems of environmental preservation in the country and world demand realization of human activities with maximal respect of the concept of sustainable development, that is, sustainable business.

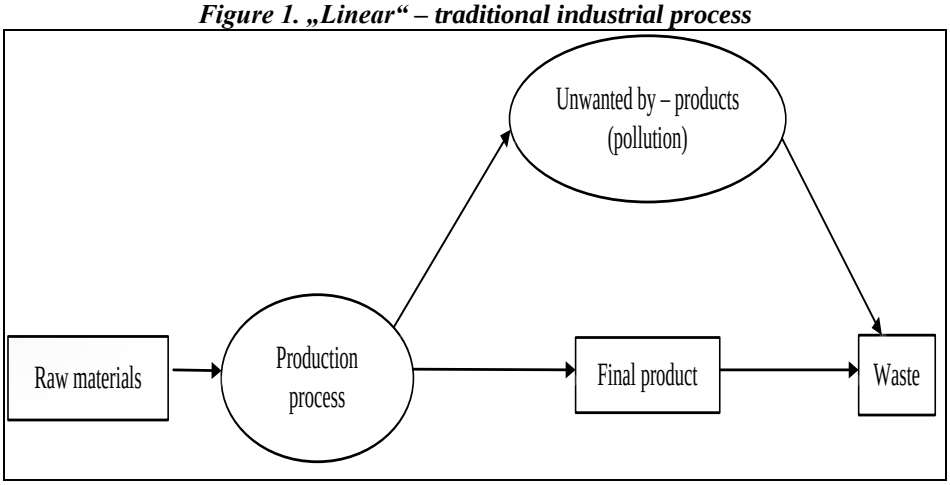
Sustainable business involves the implementation of the sustainability concept in the realization of environmental activities. The concept of sustainable development implies adjustment of three pillars: economical, ecological and social components into unique unity (Ilic et al., 2016).

Industrial ecology advocates the concept of sustainability by promoting the sustainable use of resources. The task of industrial ecology is primarily the change of the industrial processes linear nature by which raw materials provide products, by-products and waste in a cyclic process in which waste becomes the input material for another process which leads to increasing its efficiency and reducing the strain on natural resources. In accordance with volume and urgency of the needs of financing sustainable development, in recent years, the concept of green finance and industrial ecology has become more pronounced all over the world. Green financing is a positive step in the transition of the global economy towards sustainability. As a form of financing, it is implemented through the public financing, private green investments and public policies that support green initiatives. To encourage investment that provide environmental benefits, the basic tasks of green financing is in the internalization of environmental externalities and in reducing the perception of risk (Berensmann and Lindenberg, 2016). Ecologiocal costs include total costs of protection and degradation of natural. In order to overcome transfer of externalities on socal community, there are explained ways of their inclusion in price of industrial products.

2. ECONOMIC AND ECOLOGICAL APPROACH TO INDUSTRIAL PRODUCTION

Economic view on production is reflected in the transformation of raw materials into finished products. This "straight line" process from raw material to the finished product creates byproducts, pollution and waste (Figure 1) (Jonathan, 2009).

Figure 1. „Linear" – traditional industrial process



Source: (Jonathan, 2009)

Unlike economic systems, natural systems take into account cyclic patterns, and the waste is recycled and used again. Accordingly, healthy natural systems show no accumulation of pollution and waste. Looking at natural systems, it is logical to ask the question: can this principle be applied to the economic system? Many inputs into the production process are non-renewable, but it is possible to recycle them. So, recycling reduces waste generated by industrial systems and helps to reduce the consumption of resources primary reserves. Looking more broadly, the whole production process can be viewed as a circular flow in which waste (except for waste energy) can potentially become the raw material for future production. However, along with the development of production, the waste problem and its environmental impact have been developing, too. Therefore, we can say that today the state of the environment is alarming, and therefore it is high time to change our relationship towards the environment and especially the impact of industrial production on it. For this purpose, efforts have been made and principles and tools developed to try to reduce the impact of industry on the environment (Rakovac, 2011).

INDUSTRIAL ECOLOGY - THEORY APPROACH

Industrial ecology studies the physical, chemical, and biological interactions and their relationships within and between industrial and ecological systems. At the same time it studies the movement of mass and energy through industrial systems and their transformation during the manufacturing processes. Therefore, when it comes to industrial ecology as a separate scientific field, it can simply be said that it is the study of the interaction between industrial and ecological systems. However, it should be noted that the focus of study may be at different levels of the system which is the fact that brought the field the status of a scientific discipline (Ehrenfeld, 2001). When it comes to industrial ecology in literature, there is still not a generally accepted

definition. However, most of them contain similar attributes with special emphasis on some of them and they are (Allenby and Allenby 1994):

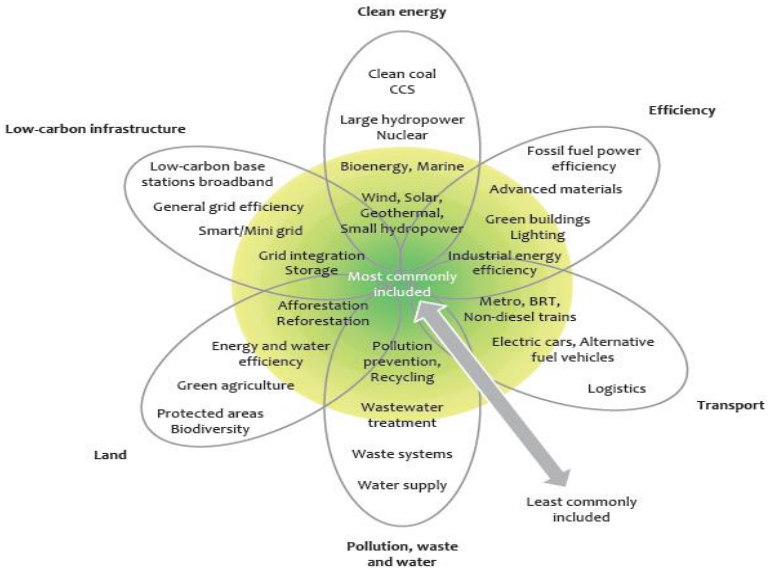
- systemic view on the interaction between industrial and ecological systems;
- change from linear (open) processes to cyclical (closed) processes, so that the waste from one industry could be raw materials or input for other industries;
- reducing the impact of industrial systems on natural ecosystems;
- reducing the environmental impact of industrial systems on natural ecosystems;
- integrating industrial activity into ecological systems;
- the idea of creating an efficient industrial system modeled after sustainable natural ecosystems;
- systems identification and their comparison with the natural systems that indicate the field of potential research and activities.

The lack of clear and uniform definition shows that it is still a new field of a multidisciplinary science. Given the foregoing, in defining industrial ecology, it is necessary to consolidate all previous definitions into a unified one.

DEFINITION OF GREEN FINANCE

While the term "green finance" is increasingly used globally, it does not have a universally agreed definition. The G20 Green Finance Study Group in 2016 described green finance as the "financing of investments that provide environmental benefits in the broader context of environmentally sustainable development". It includes definitions at the level of financial instruments (green indices or green bonds), subsectors of the financial market (green insurance or green banking), definitions used by international organizations (OECD), as well as national and international definitions (G20) **(**Lindenberg, April 2014). Several definitions of "green finance" can be found in the literature. According to Zadek and Flynn "Green finance is often used interchangeably with green investment" (Zadek and Flynn, 2013). However, in practice, green finance is a wider lens including more than investments as defined by Bloomberg New Energy Finance and others. Most important is that it includes operational costs of green investments not included under the definition of green investment. Most obviously, it would include costs such as project preparation and land acquisition costs, both of which are not just significant but can pose distinct financing challenges." (Zadek and Flynn 2013). Although the absence of a universal definition creates methodological challenges, the mapping of existing definitions has highlighted a broad convergence of definitions, as illustrated in Figure 2.

Figure 2. Components of Green Finance definitions



Source: United Nations Environment Programme (UN Environment), 2017.

There are different types of green finance instruments and services provided by the financial sector, including financial mechanisms, financial products and structural support and services. Some of them are the green bonds, green funds, public & institutional investors, private funds, intermediation of environmental products (carbon credits, emission allowances, RECs), ESCOs, local banks and other (Ministry of Economic Affairs and Employment of Finland, 2017). Based on the fact that development of environment industry, requires large capital and long term return on investment, it is essential that each country has own unique way of financing.

METHODS OF CALCULATION OF ECOLOGICAL COSTS

Ecological costs are made as direct implication of the activities which are undertaken with the goal of preservance of quality of the environment (Bergstrom and Randall 2016). The concept of ecological or environmental costs itself has two dimensions – private costs which are cause by company's activities and so-called social costs which are observed on the national level, which the company is not directly responsable for. Of utmost importance is adequate covering and accounting treatment of ecological costs. It is not simple, taking into accout, specificity of ecological costs in comparison withconventional company's costs. One of the great problem which ecological accounting is dealing with is recognition and qualification of ecological costs (Jasch, 2003). To some environmentalprotection costs, quality of latency and impalpability is characteristic. Because of those qualities the problem of their identification appears. On the other hand, significant part of eco-costs is related to possiblity of occurence of future events. Because of all that it is certain that the accountig has a complex task of coverong, quantification and systematzation of environmental protection costs. That is the question: in what quantity can environmental protection costs be value expressed. In all those cases when quantification is not feasable, we approach to assesment of the costs. Integration of ecological aspect of business into traditional activities of a company requires revision of existing and developing of a new model of costs calculation. Increasing the level of general costs in the structure of total costs and their distribution onto activities, processesor products which they caused, provoke developing of use of specific methodologies which are suitable for covering and measuring of ecological costs and benefits. Accordingly, measuring of environment protection costs represents special problem in many companies (Tietenberg and Lewis 2014). There is no unique system by which we can calculate all expenses and costs that one organization makes in order to implement the concept of reduced pollution. Some of the methodological bases which are used forneeds of ecological accounting are: ABC model (Actitivity-Based Costing), Cost of Quality Model, Business Process Re-Engineering/Cost Reduction, TQM model (Total Quality Management) and Caisen technicque as a model which follows life cycle of a product. The method which provide consideration of total social effects of the project is Cost-Benefit Analysis. Unlike classical methods of market analyses which cover profits, costs and profitability of the project itself and which are componenet of every investment project, Cost-Benefit Analysis, in its approach, includes finacially measurable and immeasurable social benefits and costs. By Cost-Benefit Analysis based on financial measurable social benefits and damages we calculate netto current value which with evaluation of finacial immeasurable social benefits and damages is used for total assessment of the project acceptability. It can be said that this methos is optimazing instrument in evaluation of a project on the environment. It contributes finding the best solutions in decision making of acceptability or unaceptability of a project, primary, because of adequate option of the project or decision between two alternatives. Cost-Benefit Analysis is not any method in economics. That is relatively an old approach which has been used for some time in the course of assessment of mutuallydifferent projects (Abelson, 1979). Philosophy of Cost-Benefit Analysis is based on assumtion that today in the modern society it is not possible to realize any project which will not harm anyone (Mechler, 2005).

Recognition and qualification of costs and profits in environmental protection is significant for assessment of profitability of companies or projects which can effect the environment. Ecological accounting can, with correct identification of environmental costs, contribute realization of the project of introduction of cleaner production and at the same time save and improve effects of environmetal protection (Preziosi et al., 2016).

CONCLUSION

The imperative of the future must be reduction of emissions of pollutants, preventing environmental degradation and preserving resources and healthier people. Industrial ecology contributes to changing the way of work and production and harmonizing industrial development with ecological principles. The strategic importance of industrial ecology is reflected in the creation of industrial ecosystems for the sustainability of life on the planet, achievement of maximum productivity with minimum consumption of material and energy, as well as minimal production of waste and pollutants. Identification of environmental costs makes possibilities of their book keeping and reporting. In this way, the modern scientific disciplines introduce the new concept so called "green concept" and it refers to all types of activities that include environmental protection. We can often hear the concept of “green accounting”, which includes financial and management accounting environment. Economy, as modern science includes these costs in its calculations, and on that way it becomes also sustainable.

Green financing is a concept that combines the power of finance and operations with power of the environmental behavior. This is big area which includes individual and business consumers, producers, investors and financial lenders. Depending of the number of participants, green financing can be expressed in different ways. On the one hand it may be due to financial incentives or it may be the desire to save the planet. On the other hand, it may be a combination these two. Unlike traditional financial activities, green financing more emphasis the benefits of environmental and industry protection, paying more attention to environmental protection (Wang and Zhia, 2016).

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