

## **Innovative Strategies to Increase Economic Efficiency of Greening the Economy**

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**Abstract:** The paper is to study the theoretical and methodological ways to optimize environmental and economic efficiency. The problems of identifying the characteristics and key factors of greening the regional economy are solved. The contradictions and directions of region green development were studied and the influences of the ecological factor on the economic efficiency have been determined. The concept directions of forming greening tasks were identified. The innovative strategies impact on greening objects and scientific approaches for the calculation of indicators of environmental losses in the assessment of environmental and economic efficiency were analyzed. The main factors and the tools for greening the economy are examined. The conclusions about the methodology for decision-making process through ecopolis approach are given.

**Key words:** Ecopolis • Instruments for increasing efficiency • Greening the economy

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### **INTRODUCTION**

Deep understanding of greening the economy requires researching dynamic transformation at the socio-economic and ecological systems. Ecologically oriented economic development must be closely linked to the sustainable use of natural resources and waste management, support biodiversity, ecosystem conservation and economic use of natural resources potential. The concept of sustainable development provides insight on ways to improve development.

The main reasons for the disequilibria in the world economy are consumption and ecological damage. To prevent pressure on the natural environment, economic system must constantly respond to these drivers of destruction. It is most necessary to reduce the pressure per unit of goods and services produced and consumed. Achieving the sustainable development and to green the economy is a difficult task.

Problems of greening the socio-economic development deal with management of the region systems. Effective transformation for greening the economy is possible only when it is based on the use of a complex set of drivers of progress. A key role is reserved for ecopolis approach. Considering the preconditions of greening the economy we have found that ecopolis approach is useful for decision-making process and can be applied for increasing environmental and economic efficiency.

Ecopolis is ecologically oriented region's economic development—a dynamic transformation of the economy, taking into account the principles of sustainable development through innovative approaches.

### **MATERIALS AND METHODS**

Researchers and scientists tend to analyze efficiency of economic systems, but it is not a consensus in a view of the problems of greening the economy [1, 2, 3]. For this reason the aim of this paper is to explore theoretical and methodological ways to optimize environmental and economic efficiency based on the ecopolis approach. To achieve the aim of the paper, authors set up the following tasks:

- To describe the ecopolis approach based on previous research;
- Based on the ecopolis approach to offer three basic strategies for greening the economy;
- To analyze ways to optimize environmental and economic efficiency taking into account the environmental damage from production.

Material used for this research is scientific research articles, published in journals, conference proceedings, books and monographs. Based on available information and author's previous results we develop ways to optimize environmental and economic efficiency.

## RESULTS AND DISCUSSION

In our opinion, the forming of ecopolis is the strategic direction of the innovative socio-ecological-economic development of territory where industrial activity is consistent with natural processes and environment-friendly attitude to the environment [4]. The authors understand ecopolis as the scientific and industrial-educational complex, which functions are to create and implement innovative environmental product lines (ecologically sound goods) for greening the economy. This form of territorial development is able to accumulate in the economic potential for a gradual transformation of the existing innovation centre in the "life", which will increase the share of production and consumption of goods for environmental purposes, as a means of making a profit in the economic sphere [4, 5].

The main goal of ecopolis is a profit from sales of innovative products for environmental purposes (ecologically sound goods). It may directly or indirectly contribute to solving some environmental problems.

The ecopolis is innovative ecologically oriented transformation of region economy. It does not cancel and do not substitute for environmental protection, but increases in both business entities and in the management of desire and motivation to achieve environmental objectives through greening the economy.

There are three major and a number of providing components of ecopolis. The main components are in interrelated areas: research (science), production, education, which forms a key triad of ecopolis [2].

### **Function Key Areas Can Be Described as Follows:**

Science-generate scientific ideas of design and technological training, support market research, production and operation support.

Manufacturing-implementation of ecological goods appointment; production of goods, services, marketing and sales, support under exploitation or consumption, monitoring production, sales and service.

Education-training of specialists for science, production and exploitation; retraining of specialists, the impact on demand due to increasing of environmental literacy of future specialists of the economy and their families.

Some functions are performed by organizational (coordination) level of ecopolis, which forms a body of local governance or management structure of education or research and production association.

Organizational core-the integration of individual departments and units around a common goal; linking

their organizational, financial software (including the search for additional sources), motivation activities to achieve common goals, ideological support.

The best conditions for the functioning of ecopolis are created when its main members are tied to some formal organizational structure that operates within technopolis, technological park, business incubator and more. Various economic actors can be linked with common purpose and ability to obtain additional economic outcomes within the existing informal structures.

The external environment includes units of the economy that are not formally members of key triad ecopolis, but they perform very important functions of its activities.

The main difference between functions that perform direct participants of ecopolis and business environment is transmitted by keywords "provision" and "support." Formal members provide (which means responsibility for its financial results) operations of ecopolis, the subjects of the environment support this activity with certain motives [5].

Among the major benefits offered by ecopolis approach include:

- The gradual development of markets for environmental goods and services, increased export capacity,
- The conversion of productive capacity towards improving research and information capacity and reduced material and energy intensity of production,
- Efficient use of facilities of scientific and industrial complex,
- The reduction of destructive pressure on ecosystems and healthy human environment;
- Creating conditions for the export of educational programs for environmental friendly products which will be produced for export.

These are the reasons and the basis for the development of green economy and a basis for ecopolis innovations.

Ecologically sound goods are one of forms of high technological and information goods. Any material, information or material-information goods which assist removal of the reasons of ecologically destructive influences can be considered as the ecologically sound goods. It can be the environment protection equipment and technologies, educational services, the ecological literature, administrative technologies, etc. Answering fundamental economic questions, which consists an

Table 1: Classification of ecologically sound goods [6]

Classification signs	Types of ecologically sound goods	Examples
Purpose	Consumer goods	Filters for potable water, counters
	Industrial goods	Energy-saving equipment
	Organizational technology	Computers, phones, faxes, modems
Economic life	The goods of short-term use	Ecological washing-up liquids
	The goods of long-term use	Electro mobiles, software
Consumer demand	The goods of daily use	Organic food, hypoallergenic means
	The goods of a preliminary choice	Non-polluting doors, window blocks
	Specialty goods	Rare species of animals, plants
	The goods of passive demand	Ecological insurance
Industrial structure	Equipment	Energy saving machine tools
	Knots and units	Ecologically effective elements of technological systems
	Ecologic raw materials and materials	Raw materials without arsenic
	Industrial services	Services in installation of ecologically effective equipment
	The intellectual goods	Ecologically focused technology
The stages of product life cycle	Mono-functional	Eco-effects on the one stage only
	Poly-functional	Eco-effects on the several stages
Positive influence on the environment	The goods reducing use of natural resources	Resource-saving technologies, recycling
	The goods improving the environment quality	Toxic wastes utilization, sewage purification
	The goods positively influencing on population	Life safe systems, organic food
	The goods positive influencing on the Earth ecosystems	Ecological researches and monitoring
Market appointment	System forming goods	Ecological management, audit
	Technologic goods	Eco-engineering, eco-modernization
	Financial goods	Ecological crediting, insurance
	Consumer goods	Non-polluting furniture, medicine
	Savings goods	Energy-saving technologies
	Communicative goods	Trading in ecological technologies
	Driving goods	Ecological marking, certification
	Reproductive goods	Forestry, reclamation of land
	Information goods	Eco-monitoring, eco-researches

Table 2: Priority types of product innovation in the environmental direction of ecopolis [3]

Priority types of products	Typical types of products
1. Means of nature conservation	1.1 Means to prevent eco-destructive impact (pollution control equipment and technologies for soil protection etc.).
	1.2 Means for liquidation of adverse environmental impact (means for decontamination of soil, soil remediation technologies, etc.).
	1.3 Means for protection of human, technological and natural systems from eco-destructive effects (filtering water before use, air conditioners, protective coatings, etc.).
	1.4 Means for increasing the immunity of a person or resilience of ecosystems to the impact of eco-destructive factors.
2. Goods environmental improvement of technological systems	2.1 Environmentally effective elements of technological systems.
	2.2 Works and services that contribute to environmental improvement of technological systems (consulting services, modernization, etc.).
3. Products that increase the efficiency of the life cycle of products and services	3.1 Goods (including information services) allowing to replace "dirty" products and processes with "clean."
	3.2 Goods that promote saving materials and energy resources.
	3.3 Technologies that reduce resource intensity of goods.
4. Goods of lifestyle greening	4.1 Education and information services (environmental training, consulting, etc.).
	4.2 Means for maintaining biodiversity and ecosystem stability.
	4.3 Tools increasing informational human contact with natural systems (creation of national parks, green areas, ecotourism, etc.).
	4.4 Tools promoting spiritual and physical development.

ethical imperative, it is possible to assume that ecologically sound goods production will promote ecologically sustainable development that will allow creating necessary preconditions for prosperity of future generations.

The analysis of the world ecological markets has allowed developing classification signs of ecologically sound goods (Table 1).

The increase in production and consumption of ecologically sound goods is capable to ensure achievement of such purposes: production of the means directed on these or those forms of softening of ecological pressure on the environment; restructuring of economy by replacement "difficult" (material-intensive and energy-intensive) kinds of primary processing of natural resources by sectors of economic activity on

final consumption production; solving of the problem of investment sources (after all ecologically sound goods are first of all the goods for sale which are paid by the consumer instead of investing in the nature protection means subsidized largely from the budget).

Ecologically sound goods can be also classified according to priority goals they have to solve in society (Table 2).

In market system needs of the people is the main driving force of social development in general and manufacturing in particular.

The process of cleaner production should be a system that constantly reproduces the basic interrelated and interdependent system elements. The main components of the reproductive mechanism of ecological and economic complex can be classified:

- Reproduction of environmental demand;
- Reproduction of environmentally oriented production base;
- Reproduction of environmentally oriented human factors;
- Reproduction of greening motives [7, 4].

Reproduction of environmental demand can be considered as processes of constantly reproducible needs in ecologically sound goods and creating financial feasibility of those requirements.

In turn, ecologically sound goods can be considered as products and services, production and consumption of which reduces the integral environmental impact per unit of gross national product.

Based on the production-consumption cycle, it is easy to conclude that to reduce environmental press can bring the refusal of the most damage intensity consumer products (those that have the most eco-destructive chains), shortening of the chain (replacement of primary natural resources on those that waste recycled), production efficiency (increasing the depth of use of material and energy resources) and, finally, the overall reduction of material and energy consumption of commodities (Fig. 1).

It is important to formulate main economic operating conditions of ecopolis functioning in particular and greening of economy in general.

Reduction of material and power consumption goods should not lead to lower quality of service vital human needs. Otherwise it may be unpredictable compensatory flow of products and services for patching "breakthroughs" in consumer standards.

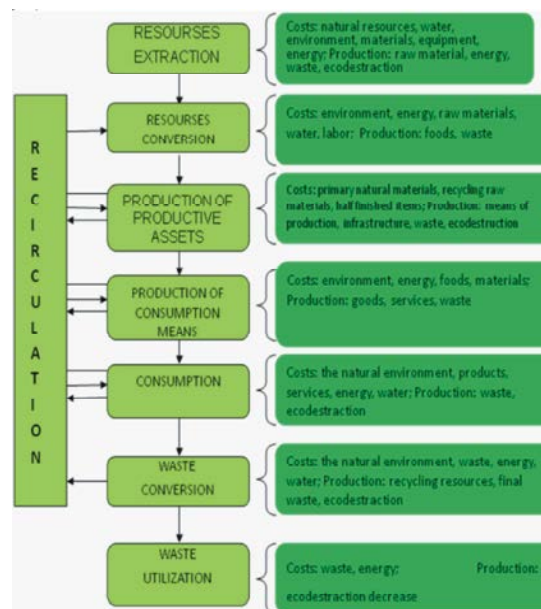


Fig. 1: Production-consumption cycle. Source: Authors' construction

Production of these goods can bear nothing expected environmental successes.

Refusal from consumption of environmentally harmful products have to be offset by increasing use of environmentally sound goods so that the total cash sales of products and services and consequently, their production did not decline (ideally they should continue to grow). This is extremely important because production is the only source of livelihood of people in the world today. Even its slight decrease can lead to significant socio-economic consequences because of multiple contacts. Among them-the decline in living standards of people, unemployment and so on. Moreover, the reduction of national income may weaken the scientific and technological potential, to reduce filling in the budgets of different levels, which ultimately can lead to deterioration of opportunities to solve environmental problems. Thus, reproduction of demand for ecologically sound goods and services is a major component of ecological economics [8].

Formation of demand for ecologically sound goods is due to the formation of three interrelated economic elements: needs, interests and capabilities.

Requirements- a type of product (in close contact with their inherent characteristics, quality indicators, functions), in which people have a need. Being conscious specific people or groups, the needs are transformed into interests, motives to purchase goods. Demand is interests, supported by financial resources.

• Resource economy	→	• Ecological management of material flows
• Waste material use	→	• Recycling material use
• Waste energy use	→	• Energy saving
• Orientation on products	→	• Orientation on functions
• Nature protection; reaction on consequences	→	• Nature saving: reasons elimination
• Over limit environment use	→	• Balanced environment use
• Management of natural processes	→	• Natural integration with the environment
• "Waste" mentality	→	• "Saving" mentality

Fig. 2: Scheme of conceptual directions of forming greening tasks [4]

Today it is clear that the basic needs of humans are: clean air to breathe, clean water to drink, uncontaminated food. When one realizes that need to move from the industrial zone, set in the kitchen wastewater treatment system, abandon to cheap products that may contain residues of pesticides or preservatives – we can talk about the emergence of interest to ecologically sound goods. Only when people appear means for pursuing their interests, there is a corresponding demand for ecologically sound goods. This can happen only with two conditions: either people become wealthier and they will have extra money, or they give up parts of other needs in favour of environmental ones. To greening of society in today's Ukraine shall be provided and implemented both conditions.

Reproduction of ecologically oriented industrial base can be considered as generation of scientific ideas, formation of informational materials, creating hardware and technology solutions that promote environmentally sound production systems.

The efficiency of environmentally oriented industrial base depends on social, economic and technological conditions that exist in the country. Ecological entrepreneurship contributes to the country's economic potential and solving of social problems.

Specifying goals of ecopolis formation across the region makes it possible to formulate specific objectives of economic transformation of the complex, which, in particular, can be classified as:

- Restructuring of economic sectors and regions;
- Eliminating (reducing) the need for ecologically unfavourable types of products or services;
- Replacement of ecologically unfavourable technical process;
- Reduction resource intensity products etc.

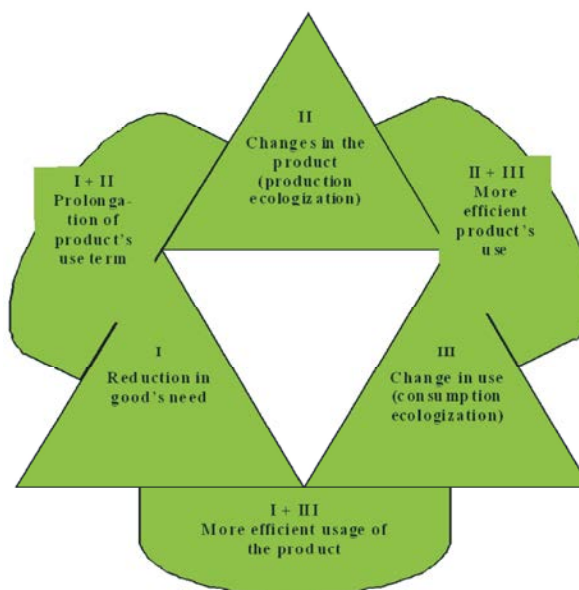


Fig. 3: Innovative strategies impact on greening objects [5]

To implement innovative change environmental focus it is extremely important to identify the objects and subjects of greening.

Objects of greening should be understood as objects of eco-destructive impact that is expected to transform to achieve greening goals. In turn, objects of eco-destructive impact can be considered as processes of production and consumption of products or products themselves (products, services and useful work), use of which creates reasons of eco-destructive impact.

Important components of innovative environmental activities are forming of conceptual directions of greening tasks and (Fig. 2) innovative strategies impact on greening objects.

Based on selected areas can be offered three basic and three interim strategies for recognition of greening (Fig. 3).

**These Basic Strategies Can Be Classified as Follows:**

**Strategy I:** Reduction in demand for the product. **Strategy II:** changes in the product to improve its environmental performance. **Strategy III:** changes in the use of the product to improve the environmental processes of consumption and waste consumption.

**Strategy I:** Is to avoid the consumption of certain foods or to reduce the need for any kind of product. The last means reducing material consumption in consumer demand. This is directly related to greening objectives,

because of manufacturing any product in some way connected with the production materials and energy and, thus indirectly cause ecologically destructive influence. The priority is the abandonment of environmentally unsound products or replacing them with cleaner. The consequence of this strategy may be to reduce material and energy intensity of production, improving the structure of consumption, the rejection of the goods and services that are not essential for human.

**Strategy II:** Applies to all kinds of changes of the product, including harm reduction resources (including by replacing harmful resources into less harmful) and/or processes used to manufacture the product. Separately, it is the elimination of the properties of the products that may pose an environmental hazard at the consumption stage of the product.

**Strategy III:** Applies to all types of changes in the use of products or recycling its waste, reducing the influence of the ecologically destructive processes. Examples of these changes are the following: the introduction of techniques uses the product safely, limitations in space and time of these products in areas where its use can cause extremely hazardous environmental effects. One of the cases-rising the environmentally sound recycling of this product.

As intermediate strategies can be formulated approaches based on a combination of the three basic strategies.

**Sub-Strategy I + II:** Changes in the product. This causes elongation of the life term of the product (longer life, better repair ability, improving quality, strength characteristics, function, range of products, etc.

**Sub-Strategy II + III:** Improvement of product design in improving their environmental performance while consuming: the same direction includes solutions that facilitate recycling of waste (or raised the level of recycling) of the product after the product life.

**Sub-Strategy I + III:** more efficient use of production: application of the thrift and rational use of the products, the recycling of products, etc.

**Subjects Influence:** Analysis of the possible impact of the subjects can distinguish several groups of "actors" greening process: businesses, organizations and individuals working on that you can achieve the goals of

ecological. Relative of the problem, they can be conventionally called the primary, secondary, subjects, providing and subjects affecting.

**Primary (Direct) Subjects:** Those who are directly responsible for the processes of environmental degradation. This group may include production and consumers, trade, transport organizations, providing movement of products from producer to consumer, as well as companies which carry out the collection, processing, disposal or recycling of waste.

**Secondary (Indirect) Economic Actors:** Those that affect the primary economic actors and can facilitate decision-making in the direction of recent policy greening. This group may include organizations, which are all forms of association of the primary subjects. They can serve as scientific, informative, educational software, including certain administrative functions (departments, associations of producers, trading companies, consumer associations, centres for retraining, industrial research institutes and design bureaus).

**Subjects, Providing:** form the legal field or motivational effect on the first two groups. This group includes state government agencies, organizations of local administration.

**Agents Affecting:** can exert influence on the behaviour of the above three groups of subjects. This group can be classified as non-governmental organizations, the media, education and educational institutions, etc.

These groups form the subjects of four laps around the problem (object) greening. The first inner circle form the primary actors.

**Tools of Greening:** The main function of the tools is the formation of motives to achieve greening. As for reasons of ecologically destructive influence motivational tools can be divided into two groups: direct motivation tools and instruments of indirect motivation.

Tools direct motivation focused directly on objects greening they either ecologically destructive factors influence (processes, hazardous substances, etc.), or to the products and services that are native ecologically destructiveness (their production and consumption associated with harmful effects on the environment). The development of green economy through a system of organizational activities, innovation, restructuring the production and consumer demand, technological

conversion, rationalization of nature, the transformation of environmental activities that are implemented at both the macro-and microeconomic levels. This requires the development of criteria evaluation framework the environmental performance of products, which creates prerequisites for improving the reproduction mechanisms of development of green economy [7].

Thus, the main concept of greening the economy is to reduce economic and environmental losses that are caused by traditional production. The methodology of environmental damage evaluating [1, 7] allows forming the scientific approach to optimize environmental and economic efficiency taking into account the environmental damage from production.

One of the possible ways to optimize the environmental and economic efficiency at the macroeconomic level is maximization of economic benefits from green production and environmental losses. The effect ( $E$ ) of region economic systems can be expressed by the following equation:

$$E = \sum_{i=1}^n (Q_{i_2} - Q_{i_2} \cdot L_{i_2}) - \sum_{i=1}^n (Q_{i_1} - Q_{i_1} \cdot L_{i_1}) \rightarrow \max \quad (1)$$

where:

- $Q_{i_1}$  -the total GRP for the current year, UAH.
- $Q_{i_2}$  -the total GRP for the previous year, UAH.
- $L_{i_1,2}$  -specific losses from pollution per unit of output of industries and activities, UAH/ton.

$i$ -number of production of goods and services, due to which the green strategies can be realized.

Scientific methodological approaches take into account indicators of environmental losses in the assessment of environmental and economic efficiency. It is possible to take into account the environmental dimension due considering indicator of environmental losses in the national economy.

$$E_{ex/im} = \sum_{i=1}^n (q_{e_i} - L_{e_i}) + \sum_{j=1}^m (q_{im_j} + \Delta L_{im_j}) \rightarrow \max \quad (2)$$

where:

- $L_{e_i}$  -damage of production of  $i$ -th unit of exported goods;

- $q_{e_i}$  -the amount of tax revenue from exports of  $i$ -th type of product;
- $q_{im_j}$  -the amount of tax revenues on imports of  $j$ -th type of product;
- $\Delta L_{im_j}$  -the value of prevent ecological and economic damage caused by  $j$ -th type of the green production.

## CONCLUSION

Creation of special ecologically oriented region's economic systems is a dynamic transformation of the economy. The aims of greening economy can be achieved by environmental friendly decision-making process.

The results show that one of the most effective forms of regional innovation systems is ecopolis.

Ecopolis approach creates opportunities to combine of three groups of objectives: economic, social, environmental.

Successful implementation ecopolis enables solving complex important economic tasks:

- Production of competitive products;
- Increase the export potential of the region;
- Increasing the share of high-tech products and high-tech sectors;
- Improving efficiency by reducing resource-products;
- Reduced demand for primary resources;
- Getting the opportunity to create more jobs;
- Improving the image of the region through specialization in the production of socially necessary goods.

Some positive steps are observed in areas forming economic efficiency at the macroeconomic level.

Ecopolis approach can be implementing at the regional level. Innovative changes of greening regional economy and forming positive decisions based on prevention of ecological damage will be the instruments of increasing economic efficiency.

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