

commercialization of scientific achievements, increasing the efficiency of scientific and technical activity because they remain those of the most essential for economic and social development of the country.

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### ДЕРЖАВНЕ СТИМУЛЮВАННЯ КОМЕРЦІАЛІЗАЦІЇ ІНТЕЛЕКТУАЛЬНОЇ ВЛАСНОСТІ

*У статті викладено розуміння суті процесу комерціалізації та виявлено її характерні риси. Визначено основні напрямки державного стимулювання комерціалізації інтелектуальної власності. Наведено механізми державного регулювання, застосування яких може бути доцільним в українській практиці.*

*Ключові слова: комерціалізація, інноваційна діяльність, інтелектуальна власність, науково-технічні розробки.*

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### ГОСУДАРСТВЕННОЕ СТИМУЛИРОВАНИЕ КОММЕРЦИАЛИЗАЦИИ ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

*В статье изложено понимание сути процесса коммерциализации и выявлены ее характерные черты. Определены основные направления государственного стимулирования коммерциализации интеллектуальной собственности. Приведены механизмы государственного регулирования, применение которых может быть целесообразным в украинской практике.*

*Ключевые слова: коммерциализация, инновационная деятельность, интеллектуальная собственность, научно-технические разработки.*

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### STATISTICAL ESTIMATION OF THE GREEN GROWTH IN UKRAINE

*A set of indicators proposed by the OECD that assesses economic opportunities arising from the green growth as well as helps policy-making concerning environmental issues, in particular indicators on technology and innovation, production and consumption of environmental goods and services, environmentally related prices and transfers as well as associated to green growth financial flows, have been studied in detail in this article. The results of the comparison analysis of the application of the abovementioned indicators by the Czech Republic, Denmark, Germany, the Netherlands and Korea are presented in the article. Based on the performed analysis possible application of the proposed by OECD set of indicators to the Ukraine's national context has been explored. Proposed set of green growth indicators can be applied in Ukraine, however further development is required to enhance the statistical data accounting and availability. Among the main challenges to the implementation of such system in Ukraine is the lack of data as well as medium compliance of the Ukraine's Environmental Accounts with the European regulation, which complicates the development of national policy towards green economy and the international comparison.*

*Keywords: green growth; green economy; indicator; economic opportunity; policy response.*

**Introduction.** An extensive use of the environmental resources over the last few decades, the intention of the governments to reach the target of economic growth by no means has led to partial loss of biodiversity, climate change and deterioration of life conditions in certain areas. Years of academic research and political discussions resulted in the international agreement for an alternative path of development that is sustainable development. Establishing a clear system of environmental accounting has become a key for a transparent policy-making system. According to the final report of United Nations Economic

Commission for Europe Ukraine's Environmental Accounts are partially compliant with the European regulations [1]. Therefore there is a need to reform the environmental accounts in order to provide a proper evaluation of the natural asset base and changes in it.

It is established that sustainable development cannot be achieved under the current pattern of consumption; therefore an alternative way of organising the economic activity, in particular green economy, has been proposed. Green economy aims for improved human well-being and social equity, while significantly reducing environmental

risks and ecological scarcities. The concept of green economy rests on the economy, the environment and the social pillars of sustainable development. In this framework, green production includes technologies, goods and services, which aim to enhance resource and energy efficiency, protect the environment and climate and reduce the use of non-renewable energy sources.

Green growth seeks to fuse sustainable development's economic and environmental pillars into a single intellectual and policy planning process, thereby recasting the very essence of the development model so that it is capable of producing strong, stable and sustainable growth simultaneously. It aims to foster economic growth and development, while ensuring that natural assets are used sustainably, and continue to provide the resources and environmental services on which the growth and well-being rely [2]. It promotes a cost-efficient and resource efficient way of guiding sustainable production and consumption choices and explicitly accounts for the environment and the value of natural assets [3].

**Analysis of the latest scientific research and publications.** Setting conditions that promote green growth requires a good understanding of its determinants as well as appropriate information to assess the environmental state, monitor its progress and support policy-making. Recently a lot of the scientific research has been focused on evaluating the impact of the economic activity on environment and its driving forces.

Among the Ukrainian scientists who have been studying this subject are S. Gerasymenko and O. Chupryna, who have performed a multivariate statistical analysis of economic development trend and standard of living [4], N. Kovtun, who analysed investment process in Ukraine from a statistical point of view [5], E. Libanova, who researched human development in Ukraine [6], I. Mantsurov, who focused on his research in the area of statistics of economic growth and competitiveness [7], as well as N. Parfentseva with the analysis of the development and implementation of International statistical classifications in Ukraine [8].

Current research in Ukraine covers different aspects of the statistical estimation of the impact of the economy on the environment, as well as its role in the human development and quality of life, however further research is needed in order to implement a multidimensional statistical framework for evaluation of the impact of green economy, as well as its state and development.

Organisation for Economic Co-operation and Development (OECD) has performed a research on the statistical data development required to assess the impact of green economy development on countries' social, economic and ecological state. OECD research has provided a set of green growth indicators as a starting point for measuring green economy, which could be adapted according to country's specific context [9].

OECD framework for Green Growth indicators includes four main groups of indicators that monitor environmental and resource productivity and environmental quality of life, describe the natural asset base as well as policy responses and economic opportunities.

**The aim of this article is** to focus on the fourth group of green growth indicators proposed by the OECD that assesses economic opportunities and aims to help policy-making.

With this aim the following objectives have been formulated and accomplished:

- to study the relevance the green growth indicators proposed by OECD to the Ukrainian national context;

- to evaluate the application of relevant green growth indicators in the Czech Republic, Denmark, Germany, the Netherlands and Korea;

- to estimate the relevant green growth indicators for Ukraine subject to data availability.

**Main results of the research.** The set of indicators on economic opportunities and policy response proposed by the OECD includes indicators that evaluate opportunities arising from greening growth, estimate the role of R&D and innovation, training and skills development, international trade and international financial flows in shaping the green economy, as well as help the policy-makers to address market failures through economic instruments and regulations. We will compare the application of the proposed indicators to the national context of Czech Republic, Denmark, Germany, the Netherlands and Korea and present our estimation of the relevant indicators for Ukraine.

Eurostat has developed guidelines on how to examine the Environmental Goods and Services Sector in 2010. Under these guidelines green entrepreneurship is both a source of innovation and a source of opportunities for economic growth. Green growth relies on innovation, which drives multifactor productivity change and helps decoupling process. Thus, it's important to construct proper indicators, which highlight its role in green economy, focusing in particular on green innovation. The latter relates to environmentally-related research and development and technologies.

Governments have an important role in fostering green growth by setting framework conditions that stimulate greener production and consumption through economic and other instruments; by encouraging cooperation and sharing of good practices among enterprises; by developing and promoting the use of new technologies and innovations; and by increasing coherence among policies. The main challenge is to harness environmental protection as a source of growth and as a source of international competitiveness, trade and employment.

Clear and stable market signals are key to affecting the behaviour of producers and consumers. In presence of negative externalities of the economic activities it's very important to set proper incentives to eliminate them while ensuring a fair price is paid for conducted economic activity. Possible political response to such negative externalities is an introduction of a tax on harmful economic activity and abolishing of existing subsidies to it, or introduction of a subsidy to an environmental-friendly technology. Regulatory instruments or environmental quality certificates also play an important role in minimising the negative externalities.

OECD system of indicators has been built holding a balance between being exhaustive and understandable. The report notes that not all issues of importance to green growth can be measured in quantitative terms.

Businesses have an important role in adopting "greener" management approaches; developing and using new technologies; carrying out R&D and spur innovation. Business, governments and civil society also play an important role in providing consumers with the information needed to make purchasing choices that reduce the environmental impact of consumption. Education, training and skills development are closely linked to the capacity to innovate.

Public policy plays a role by institutionalising environmentally-related lines of education in particular in higher education. Vocational Education and Training is equally important in raising awareness about environmental issues, in fostering innovation on the workplace and in facilitating the transition and development of firms and the workforce into a low-carbon economy [10]. These areas have often

been under-represented in scoreboards of indicators, one reason being the difficulty of compiling the relevant data in particular for international comparisons.

The main issues of importance to green growth addressed by OECD while assessing the economic opportunities and policy response are:

- Technology development and innovation that are important for growth and productivity in general and for green growth in particular. They are important for managing natural resources and to minimise the pollution burden. Innovation also contributes to the establishment of new markets and leads to the creation of new jobs;

- Production of environmental goods and services that reflect an important, albeit partial aspect of the economic opportunities that arise in a greener economy;

- International financial flows that are key to the uptake and dissemination of technology and knowledge, foster the cross-country exchange of knowledge and are one important aspect in combining development and environmental objectives;

- Prices and financial transfers that provide important signals to producers and consumers and, along with regulations, are tools to internalise externalities and to influence behaviour of market participants towards more environmentally-friendly patterns.

Ideally, indicators on economic instruments should be complemented by indicators on regulations. However, data availability and comparability of regulations across countries hamper the construction of such indicators.

These indicators can also be complemented with indicators on international trade as a source of economic opportunities, including green growth opportunities. Since

trade in "green" products provides a very partial picture of this role, no specific trade-related indicator has been put forward in this section. General indicators on international trade and competitiveness can be found in the section on the socio-economic context.

**Indicators on technology and innovation.** The first subset of indicators proposed in this group by OECD describes technology developments and innovation, which are important drivers for growth and productivity in an economy. While assessing the impact of innovation one has to take into account that new technologies can also generate additional environmental pressures or strain material availability.

Table 1 provides an overview of the indicators that have been chosen by Czech Republic, Denmark, Germany, the Netherlands and Korea from the proposed by OECD indicators.

Each country has made its selection of indicators proposed by OECD taking into account its characteristics and data availability as well as complemented the selection with other indicators specific to its national situation. Currently Denmark has one of the most developed systems of statistical indicators, which describe the development of green economy. 9,2 % of Danish turnover and 10,4% of Danish export derive from green technologies, goods and services. Therefore Denmark complements the OECD set of indicators with more detailed ones, which reflect the main characteristics of the innovative enterprises, in order to further understand the driving force of green innovation and green growth.

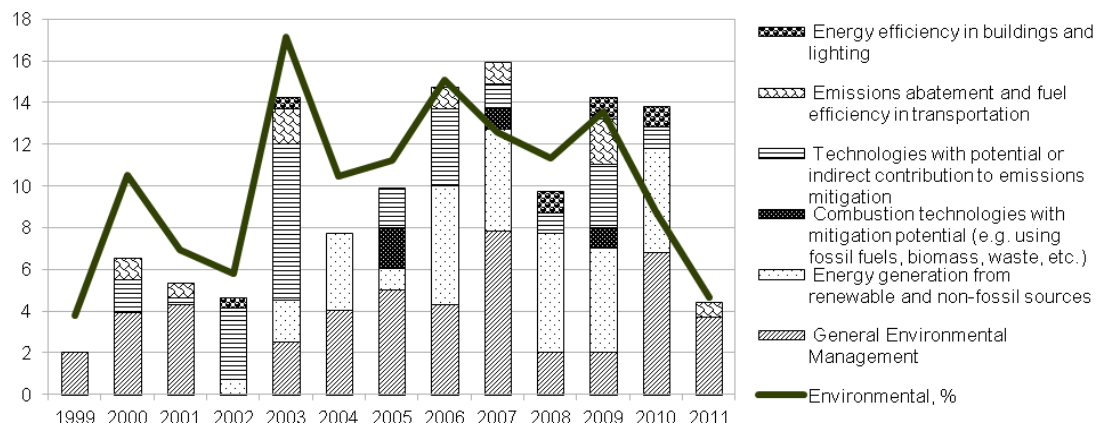
**Table 1. Comparison of the proposed by OECD and applied by selected countries indicators on technology and innovation\***

OECD	Czech Republic	Denmark	Germany	Netherlands	Korea
Public spending in energy- and environment-related R&D, as a % of GDP			+	+	
Structure of patents, as % of total applications for patents under the Patent Cooperation Treaty (PCT)	+				
Number of patent applications under PCT, index 1990 = 100		+			
Number of applications for patents of importance to green growth under PCT (electric and hybrid vehicles, energy efficiency in buildings and lightning, pollution abatement and waste management, renewable energy)			+	+	
Government R&D budget related to the environment, as a % of total government R&D budget					+
Business R&D investment (environment and all-purpose), as a % of total (incl. business, government and other)		+			
		Number of employees in R&D per 1000 employees in all and green enterprises			
		Share of enterprises interacting regarding R&D and innovation			
		Number of innovative enterprises by type, in %			

\*Source: 11-14.

In this article we would like to analyse the dynamics of the proposed indicators for Ukraine subject to the data availability. Based on the data provided by OECD we have

analysed the dynamics of Ukraine's patent applications for the period 1999-2011 (graph 1).



Graph 1. Dynamics of Ukraine's patent applications in environment-related technologies under PCT for 1999-2011\*

\*Source: 15.

During these years a positive trend has been observed in Ukraine's total patent activity, it has reached its peak in 2010 with 157 patent applications. From 1999 to 2011 Ukraine's total patent activity has almost doubled, from 53 applications in 1999 to 94,4 applications in 2011. The share of environment-related technologies' patent applications in the total patent applications has varied from 3,77% in 1999 to 15,9% in 2011. Among the applications for environment-related patents a major part belongs to patents in the area of material recycling, incineration, energy recovery, storage and generation from renewable sources.

Currently there is no statistical data available for Ukraine that allows estimating share of energy- and environmentally-related R&D expenditures done by government, private and public sector in the total R&D expenditures.

**Indicators environmental goods and services sector.** The second subset of indicators proposed by OECD in this group assesses production of environmental goods and services. The most important indicator here is the share of the environmental goods and services sector in the economy in terms of employment and value-added, along with the framework conditions in place for doing business and accessing financing. Progress towards the green growth can also be assessed against transformations in the economic sector from traditional business activities to greener activities. Table 2 provides an overview of the indicators proposed by the OECD and applied by selected countries for evaluating production of environmental goods and services (EGS).

Table 2. Comparison of the proposed by OECD and applied by selected countries indicators on EGS sector production\*

OECD	Czech Republic	Denmark	Germany	Netherlands	Korea
Gross value added in the EGS sector (in % of GDP)		+	+		
Employment in the EGS sector (in % of total employment)	+	+	+	+	+
Share of "green" enterprises in the economy (as a % of the total number of enterprises)		+			
		Export of green products and its share in total export, by industry			

\*Source: 11-14.

The main problem that arises while constructing these indicators is to identify the technologies, goods and services, which are part of the EGS sector. Statistisches Bundesamt Deutschland (SBD) following the Eurostat's guidelines has developed a list of detailed green product codes based on a German classification system, which includes 252 green product codes. Danish socioeconomic and policy consultancy DAMVAD has coordinated the research, which based on the list established by SBD has identified 4063 green product codes. In addition, Danish experts have identified green products which were not part of SBD list, thus a total of 528 green product codes has been identified for assessing the green economy development in Denmark.

It's important to note that while assessing the EGS sector, one has to take into account the adapted green products, which are defined by Eurostat as goods, technologies and services, which offer a green alternative to products which do

not have environmental and climate protection as their primary purpose, but which have been adapted to this end.

In order to assess green growth potential in Ukraine the environmental goods and services sector has to be identified following the Eurostat guidelines, example of Germany and Denmark, based on its classification of types of economic activities.

**Indicators on the international financial flows.** Another subset of indicators proposed by the OECD to assess the economic opportunities and policy responses is focused on the international financial flows that drive technology dissemination, contribute to cross-country exchange of knowledge and stimulate entrepreneurship, fostering resource-efficient progress.

The OECD proposes to estimate international public financing of importance to green growth with the amount of the official development aid (ODA) targeting the issues of biodiversity, climate change, desertification, renewable

energy, etc. Carbon market's indicators are proposed to evaluate international private financing.

Table 3 provides a comparison of the indicators proposed by OECD and those applied by the selected countries with an aim to estimate the role of the international financial flows in the green growth.

Limited use of these indicators can be explained by the lack of data, by absence of internationally agreed methodology for tracking the exact share of aid activity expenditure related to each objective and by lack of standard methodologies, which provide a comprehensive measurable indicator to assess annual investment flows into the CDM.

In case of Ukraine relevant indicators would be indicators concerning carbon market financing as well as foreign direct investment. Currently Ukraine has 184 registered JI projects and a total of 130 million issued Emissions Reduction Units (ERUs). Ukraine is also the third largest Assigned Amount Unit (AAU) seller, with 47 million AAUs contracted to date. The Ukrainian Green Investment Scheme became operational in 2010, with the first batch of projects approved in November 2010. Introduction of an emissions trading scheme (ETS) is a next step in facilitating low carbon investment in the country [16].

**Table 3. Comparison of the proposed by OECD and applied by selected countries indicators on the international financial flows**

OECD	Czech Republic	Denmark	Germany	Netherlands	Korea
ODA and its share relevant for environment and renewable energy					+
Carbon market financing: the structure of supply and demand of certified emissions reductions (CER) credits issued by Kyoto protocol's Clean Development Mechanism (CDM)			Emission trading budget and actual CO <sub>2</sub> emissions of plants liable to emission trading	Emission allowances and actual CO <sub>2</sub> emissions	
Foreign Direct Investment		Export to global emerging market			
		Number of foreign-owned enterprises			

\*Source: 11-14.

**Indicators on environmentally related prices and transfers.** The last subset of the indicators proposed by the OECD to estimate the economic opportunities and policy response consists of indicators describing environmentally related taxation and transfers, energy and water prices and cost recovery. A table providing a summary of the indicators proposed by OECD and those applied by the selected countries is presented below.

Environmentally-related taxes are an important instrument for governments to shape relative prices for environmental externalities of economic activity. Providing clear, stable and transparent market signals requires appropriate

policies to incentivise innovation and new technology adoption by firms and to facilitate environmentally efficient consumption patterns, while demonstrating a clear policy commitment of governments to move towards greener growth.

The OECD report notes that in order to judge the "environmental friendliness" of the tax system one should consider general economic and taxation structure of the country alongside with the figures on environmental taxation. The indicators reflecting economic policy instruments should be complemented with indicators reflecting regulatory measures by government. The construction of such indicators is however constrained by data gaps and conceptual issues.

**Table 4. Comparison of the proposed by OECD and applied by selected countries indicators on environmentally related prices and transfers\***

OECD	Czech Republic	Denmark	Germany	Netherlands	Korea
Level of environmentally related tax revenues (in % of total tax revenues, in relation to labour related taxes)					
Structure of environmentally related taxes (by type of tax base)	+		+	+	+
Energy pricing	Energy prices (heat and electricity)		Petrol price and taxation	Energy price (excl. taxes) and tax rate for business	
Water pricing and cost recovery (to be developed)			Drinking water charges and costs for private households		
Environmentally related subsidies					
Environmental expenditure: level and structure	+		+		+
Regulations and management approaches Indicators (to be developed)					
Training and skill development Indicators (to be developed)	Structure of educational attainment				

\*Source: 11-14.

In 2011 Ukraine has introduced a tax on CO<sub>2</sub> emissions from stationary sources. The tax was initially set at UAH 0.22 per tonne of CO<sub>2</sub>, and increased to UAH 0.24 per tonne of CO<sub>2</sub> in 2012 [16]. However, the current tax rate does not provide an incentive for GHG emissions reductions and Ukraine is planning to raise the current tax

rate and introduce more stringent monitoring, reporting and verification requirements in connection with it.

**Conclusions.** Green growth indicators have to combine both economic and environmental information, which is often difficult due to differences in classifications, terminology or timeliness. Therefore, it's crucial to develop a

consistent environment-economy accounting framework in order to fill in the existing information gaps.

The proposed by OECD framework for developing the system of green growth indicators to evaluate the economic opportunities of the green growth and possible policy responses by the government can be applied to Ukrainian National context. The main challenges to establishing such system in Ukraine are the lack of data as well as medium compliance of the Ukraine's Environmental Accounts with the European regulation, which complicates the international comparison.

Implementation of such system of indicators in Ukraine would help to properly evaluate the green growth perspectives, create the framework conditions through economic policy measures as well as regulatory measures, which help to foster innovation and the use of new technologies in production, and to encourage the creation of markets and the uptake of these technologies by consumers. This requires using an appropriate mix of policy tools and instruments, such as procurement, financing incentives, economic instruments and voluntary initiatives. Support from government R&D budgets is needed for reducing the costs of new technologies, helping to bring them to market competitiveness.

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### СТАТИСТИЧНА ОЦІНКА ЗЕЛЕНОГО ЗРОСТАННЯ В УКРАЇНІ

*В статті було досліджено набір показників, запропонованих ОЕСР, що призначений для оцінки економічних можливостей, що виникають із розвитком зеленої економіки, а також для підтримки прийняття політичних рішень щодо екологічних питань. Наведено порівняння показників, що були обрані та застосовані для оцінки зеленого зростання статистичними службами Чеської Республіки, Данії, Німеччини, Нідерландів та Кореї. Також проаналізована можливість застосування запропонованого ОЕСР набору показників для України.*

*Ключові слова:* зелене економічне зростання, зелена економіка; індикатор; економічні можливості; прийняття політичних рішень.

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### СТАТИСТИЧЕСКАЯ ОЦЕНКА ЗЕЛЕНОГО РОСТА В УКРАИНЕ

*В статье был исследован набор показателей, предложенный ОЭСР, который предназначен для оценки экономических возможностей, возникающих с развитием зеленой экономики, а также для поддержки принятия политических решений по экологическим вопросам. Приведено сравнение показателей, которые были выбраны и использованы для оценки зеленого роста статистическими службами Чешской Республики, Дании, Германии, Нидерландов и Кореи. Также проанализирована возможность применения предложенного ОЭСР набора показателей для Украины.*

*Ключевые слова:* зелёный экономический рост, зелёная экономика; индикатор; экономические возможности, принятие политических решений.