

# Green Economy Fundamentals

v4

**Dr Ahmed Gaber**

Professor of Chemical Engineering,

and

Chairman, Chemonics Egypt Consulting

March 2022

Developed with assistance from Chemonics Egypt's Review of Current Knowledge (ROCK) Team

# Purpose Statement

- This is an introductory lecture, its purpose is to present a general background about green economy followed by a brief review of theories, concepts, approaches and assessment tools.
- This is the first lecture of a package of five lectures. The other four lectures are:
  - Bio-Based Economy
  - Industrial Ecology
  - Models for national green economy strategies from developing countries
  - Green economy international initiatives

# Outline

1. GE as an Umbrella Concept
2. GE Theories, Concepts, Approaches and Tools
3. Three Important Reports

# 1. GE as an Umbrella Concept

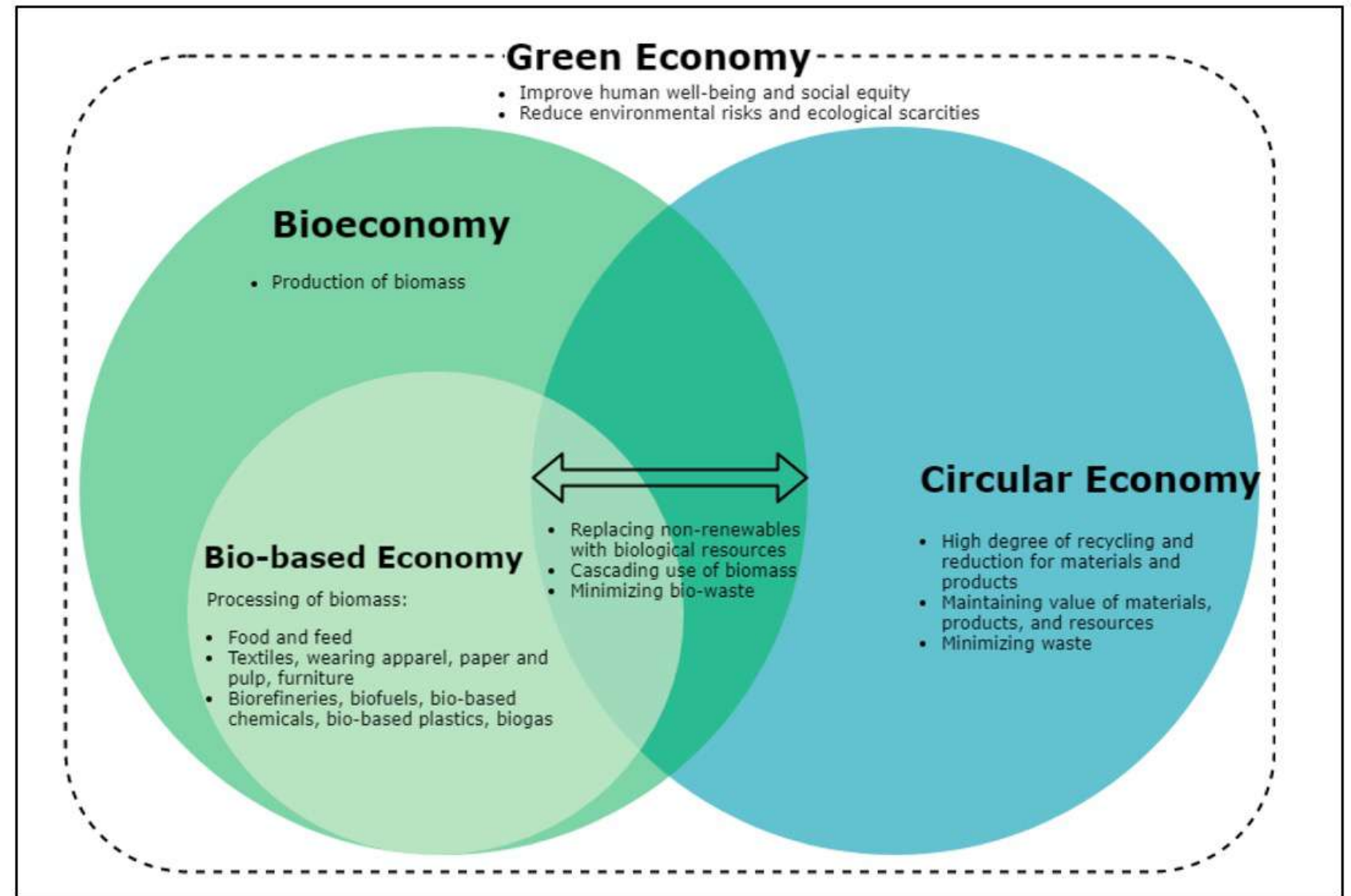
# Green Economy as an umbrella concept

## Ecology Meaning

It is the study of relationship between living organisms and environment. Its main components include individuals, species, population, community, and ecosystem. These components are determined on the basis of composition and distribution of resources such as sunlight, heat, water, nutrients, etc.

## Environment Meaning

Environment refers to the surroundings we live in. It is a combination of physical and biological components. The environment determines the climate and weather that are extremely important to all the biological forms. Any changes in the environment can alter the natural cycles and climatic conditions. The more the life forms to create their habitat, the more resourceful the environment is.



Source: Biomonitor, monitoring of bioeconomy in the EU, D1.1: Framework for measuring the size and development of bioeconomy, September 2019

# Green Economy: Definitions

Green economy is the economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive. (UNEP 2011)

Green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and the environmental services on which our well-being relies. In order to do this, it must catalyze investment and innovation which will underpin sustained growth and give rise to new economic opportunities. (OECD, 2011)

# تعريف المفضل للإقتصاد الأخضر

- هو نمط الاقتصاد الذي يعمل علي تحقيق التنمية الشاملة، ويؤكد علي البعد الاجتماعي في التنمية
- هو نمط الاقتصاد الذي يحقق الاستخدام الأمثل للموارد ويعظم العائد منها، آخذا في الاعتبار البعد الزمني والبعد الجغرافي
- هو نمط الاقتصاد الملتزم بيئيا ، يوظف التكنولوجيا الأنظف في تصميم العمليات والمشروعات
- هو نمط الاقتصاد الذي يستثمر نتاج الإبداع والإبتكار الي الحد الأقصى
- هو نمط الاقتصاد الذي يعظم العائد من رأس المال البشري ويولد قدر أكبر من فرص العمل
- هو نمط الاقتصاد الذي يستخدم وسائل غير تقليدية للتمويل
- هو وسيلتنا الأفضل لتحقيق التنمية المستدامة التي تراعي التوازن بين الجوانب المالية والإقتصادية من ناحية ، ويعمل علي تحقيق التوازن بين رأس المال البشري ورأس المال الطبيعي

# Green Economy

GE has been mainstreamed after the 2012 UN Conference on Sustainable Development in Rio (Rio+20). GE aims at bringing together environmental conservation and poverty alleviation. UNEP definition states that GE results in improved human well-being and social equity, while significantly reducing environmental risks. In its simplest expression, a GE can be thought of as one which is low carbon, resource efficient and socially inclusive. According to the GE premise, different natural assets delivered by ecosystems (i.e. natural capital) provide fundamental benefits for the economy and society, which are often invisible or disregarded.



# Green Growth Principles

The restructuring model of the economy based on green growth principles involves the following aspects:

- Pricing externalities and valuing natural assets in the long run
- Innovation as a means of eliminating unsustainable growth paths
- Establishment of new environmentally sustainable growth paths
- Creation of win–win situations through sectoral shifts and changes.

# Green Economy Principles

Table 1: Summary of most common green economy principles drawn from eight sets of published principles

Common green economy principles:	1. Is a means for achieving sustainable development	2. Maintains economic growth	3. Creates decent work and green jobs	4. Is resilient to risks and shocks	5. Is low carbon, low emissions	6. Is resource and energy efficient	7. Respects planetary boundaries or ecological limits or scarcity	8. Facilitates education and skills development	9. Drives innovation	10. Uses integrated decision-making	11. Measures beyond GDP; indicators/metrics	12. Supports human rights, workers rights	13. National sovereignty	14. International liability	15. Right to development	16. Equitable, fair and just – between and within countries and between generations	17. Protects biodiversity and ecosystems	18. Poverty reduction, well-being, livelihoods and social protection; access to essential services	19. Promotes international cooperation; avoids conditionalities on ODA and finance	20. Common but differentiated responsibilities (CBDR)	21. SCP, sustainable lifestyles	22. Governance - inclusive; democratic; participatory; accountable; transparent; stability; rule of law	23. Effective institutions, regulation, legislation	24. Open and competitive markets; avoid trade restrictions	25. Precautionary approach	26. Internalises externalities
<b>Source:</b>																										
Stakeholder Forum et al (2012)	x					x	x	x		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x
Green Economy Coalition (2011)	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x			x	x	
International Chamber of Commerce (2011)	x	x	x			x	x	x	x	x	x										x	x	x		x	
ITUC (2011)			x		x	x				x		x				x		x							x	
ANPED (2011)			x	x			x				x					x	x	x						x		
The Danish 92 Group (2012)	x		x						x		x					x			x			x				
GSP (2011)*	x	x	x	x	x	x	x		x	x	x					x	x	x	x		x				x	
UN EMG (2011)*	x	x	x	x	x	x										x	x				x					
<b>Summary/Total</b>	<b>6</b>	<b>3</b>	<b>7</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>7</b>	<b>4</b>	<b>2</b>	<b>3</b>	<b>5</b>

\*Note: These two publications do not propose formal principles for the green economy. The UNEMG (2011) proposes characteristics for a green economy that works for the poor. The Global Sustainability Panel (2011) provides background text on green growth from which characteristics were extracted.

# Green Economy Policies

Green economy stems from various policies enacted at a global level, such as the following:

- Formulation of a regulatory framework that promotes green economy
- Establishment of a monitoring and reporting to monitor successes and failures in terms of sustainable development goals and millennium development goals
- Establishment of a system for incentivizing green investment which might apply lower taxes and other fiscal discounts to promote green investment
- Applying initiatives aiming at shifting consumer preference
- Investment in capacity building and training

For serious reading

**The Transition to a Green Economy: Benefits, Challenges  
and Risks from a Sustainable Development Perspective**

**Report by a Panel of Experts\*  
to  
Second Preparatory Committee Meeting for  
United Nations Conference on Sustainable Development**

**Prepared under the direction of:**

**Division for Sustainable Development, UN-DESA  
United Nations Environment Programme  
UN Conference on Trade and Development**



\*The views expressed in this report are solely those of the authors and do not necessarily reflect those of the sponsoring UN organizations.

# Contents

	<i>Page</i>		
<b>The Transition to a Green Economy: Benefits, Challenges and Risks from a Sustainable Development Perspective</b>		<b>Trade, sustainable development and a green economy: Benefits, challenges and risks</b> by Aaron Cosbey, UNCTAD Advisor on Green Economy. ....	40
<b>Summary of Background Papers</b> by José Antonio Ocampo, Columbia University .	3	Introduction .....	40
The concept of a green economy .....	4	Transitioning to a green economy .....	40
The macroeconomic dimensions of green economic growth .....	5	Impacts of the transition in major trading partners .....	52
Developing countries' green development strategies .....	7	What role for the international community? .....	58
Domestic and international technology issues .....	9	Conclusions .....	60
International trade and investment rules .....	10	References .....	61
Financing developing countries' green economies .....	13	<b>Challenges of the green economy concept and policies in the context of sustainable development, poverty and equity</b> by Martin Khor, Executive Director, South Centre .....	69
<b>The macroeconomics of the green economy</b> by José Antonio Ocampo, Columbia University .....	16	The context of sustainable development and green economy .....	69
Introduction .....	16	Risks of misuse of the green economy concept .....	72
Valuing the welfare of future generations .....	19	Policies and measures for promoting sustainable development and green economy ..	76
Aggregate supply and demand analysis .....	21	Technology development, transfer and cooperation .....	86
Green growth as a process of structural change .....	24	Financing of sustainable development .....	89
Financing developing countries' green economies .....	27	Conclusions .....	93
Policy conclusions .....	32	References .....	94
Technical appendix: Optimal consumption paths and the social discount rate .....	34		
References .....	36		

# Bioeconomy

Bioeconomy is the sustainable and innovative use of biomass and biological knowledge to provide food, feed, industrial products, bioenergy, and other services.

Bioeconomy applies biological, systems knowledge and innovations to develop a sustainable economy.

In bioeconomy, the concepts of life cycle thinking and value chain approaches, resource use efficiency and recycling are applied to all production activities.

Therefore, the bioeconomy is an integrated and forward-looking approach striving for an overall economic system optimization.

# Circular economy

The concept of the circular economy has mostly been associated with the adoption of closing-the-loop production patterns within an economic system, and with aims to increase the efficiency of resource use, placing a specific focus on urban and industrial waste. As such, the concept of the circular economy is narrower in scope than the concepts of the green economy and the bioeconomy.

Circular Economy is defined as a regenerative system in which resource input and waste, emission, and energy leakage are minimized by closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.

# GE, CE and BE Comparisons

Ecological Economics 188 (2021) 107143



Contents lists available at ScienceDirect

Ecological Economics

journal homepage: [www.elsevier.com/locate/ecocon](http://www.elsevier.com/locate/ecocon)



Analysis

Integrating the green economy, circular economy and bioeconomy in a strategic sustainability framework

D. D'Amato <sup>a,\*</sup>, J. Korhonen <sup>b</sup>

<sup>a</sup> Helsinki Institute of Sustainability Science, Department of Forest Sciences, Faculty of Agriculture and Forestry, University of Helsinki, Finland  
<sup>b</sup> KTH Royal Institute of Technology, Department of Sustainable Production Development, Stockholm, Sweden



Journal of Cleaner Production 168 (2017) 716–734



Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: [www.elsevier.com/locate/jclepro](http://www.elsevier.com/locate/jclepro)



Green, circular, bio economy: A comparative analysis of sustainability avenues

D. D'Amato <sup>a,\*</sup>, N. Droste <sup>b</sup>, B. Allen <sup>c</sup>, M. Kettunen <sup>c</sup>, K. Lähtinen <sup>d</sup>, J. Korhonen <sup>a</sup>,  
P. Leskinen <sup>e</sup>, B.D. Matthies <sup>f</sup>, A. Toppinen <sup>a</sup>





## Main Topics Emerging in GE, CE and BE

Topic	CE	GE	BE
1	Sustainable development in industrialization and urbanization	Sustainable development	Biomass and renewables in energy production
2	Recycling in products life cycle for waste reduction	Green investments, especially in urban context	Rural policies esp. in Europe
3	Industrial symbiosis, especially in EU	Tourism, business, education, employment	Biotechnology applications in health science
4	Efficiency evaluation techniques in logistic/supply chain management systems	Biomass and renewables in energy production	Biotechnology applications in materials science
5	Carbon emission and energy in production plants	Recycling, re-use, reduction in products life cycle	Biomass supply/demand, especially wood
6	Greening the supply chain	Conservation and land use	Biosecurity

Main aspects included in CE, GE and BE concepts in regard to the social and environmental dimensions of sustainability.

Concepts	Sustainability dimensions	
	Environmental	Social
CE	Recycling/re-use, efficiency, industrial symbiosis, greener supply chain.	Economy, development, utilization.
GE	Conservation, water, land, biodiversity, food, security.	Sustainable development; Green investments, tourism, business, employment, education.
BE	Biosecurity, crops, species, risk, yield, invasive.	Rural policies; Research and applications in health science.

## Selected similarities between sustainability and the Circular Economy.

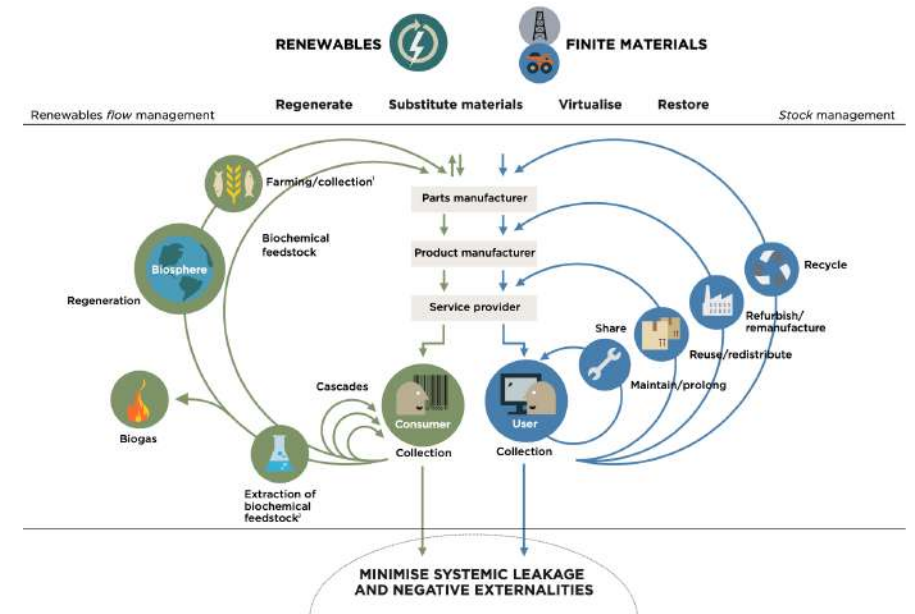
### Similarities between sustainability and the Circular Economy

- Intra and intergenerational commitments
- More agency for the multiple and coexisting pathways of development
- Global models
- Integrating non-economic aspects into development
- System change/design and innovation at the core
- Multi-/interdisciplinary research field
- Potential cost, risk, diversification, value co-creation opportunities
- Cooperation of different stakeholders necessary
- Regulation and incentives as core implementation tools
- Central role of private business, due to resources and capabilities
- Business model innovation as a key for industry transformation
- Technological solutions are important but often pose implementation problems

يمكن قراءة الجدول علي أساس أن الإقتصاد التدويري هو البديل الأحدث للاقتصاد الأخضر لأنه يتضمن كل المبادئ الأصلية للتنمية المستدامة، فهي عملية "استبدال" أو "إزاحة". ويعضد هذا أن الإقتصاد التدويري يشمل في باطنه الإقتصاد الحيوي (في الناحية الشمال)

فتكون المعادلة هي:

$$GE = CE$$



Journal of Cleaner Production 143 (2017) 757–768



ELSEVIER

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: [www.elsevier.com/locate/jclepro](http://www.elsevier.com/locate/jclepro)

Review

### The Circular Economy – A new sustainability paradigm?

Martin Geissdoerfer <sup>a, b, \*</sup>, Paulo Savaget <sup>a</sup>, Nancy M.P. Bocken <sup>a, b</sup>, Erik Jan Hultink <sup>b</sup>

<sup>a</sup> Institute for Manufacturing, Department of Engineering, University of Cambridge, Cambridge, CB3 0FS, United Kingdom

<sup>b</sup> Industrial Design Engineering, Delft University of Technology, Landbergstraat 15, 2628, CE Delft, The Netherlands

## 2. GE Theories, Concepts, Approaches and Assessment Tools

# Review of GE concepts, approaches and tools

PEER Report 2015 presents the GE concepts, approaches and tools as discussed in many publications of the UNEP and other organizations.

The same report has prepared a summary as shown in next slide

## IMPLEMENTING THE GREEN ECONOMY IN A EUROPEAN CONTEXT LESSONS LEARNED FROM THEORIES, CONCEPTS AND CASE STUDIES

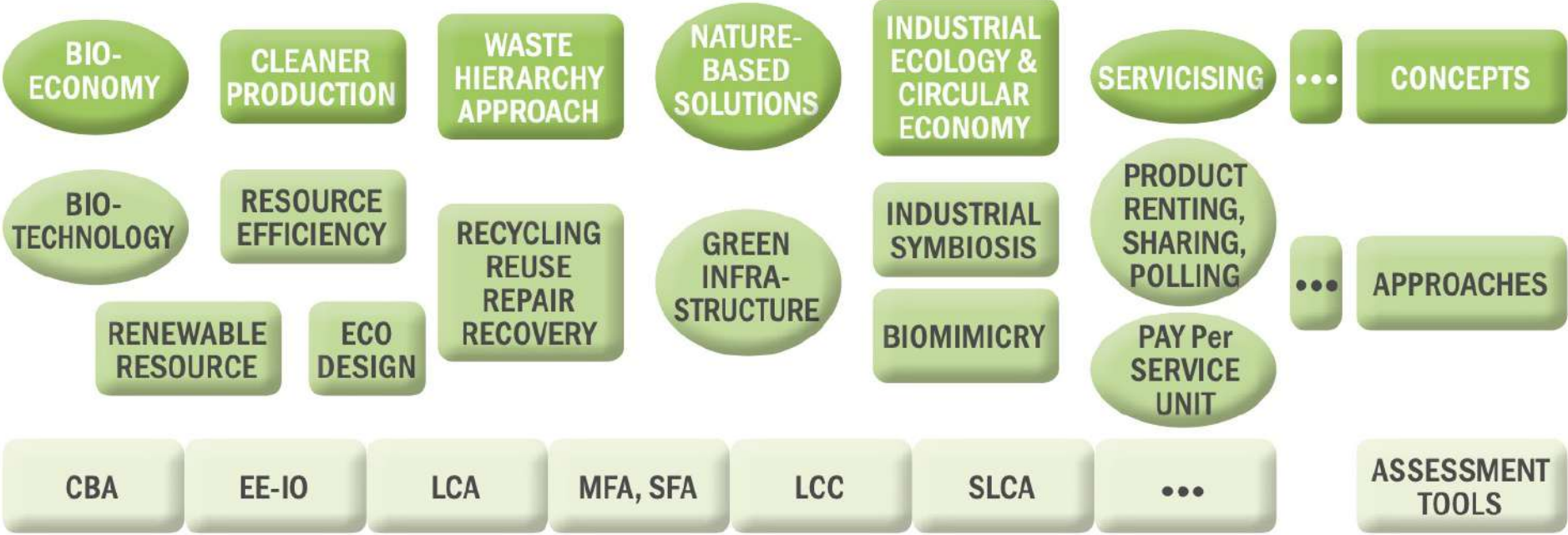
Laura Saikku, Riina Antikainen,  
Nils Droste, Kati Pitkänen, Eleonore Loiseau,  
Bernd Hansjürgens, Peter Kuikman,  
Pekka Leskinen and Marianne Thomsen

PEER REPORT

2015

# GREEN ECONOMY

## ENVIRONMENTAL ECONOMICS      ECOLOGICAL ECONOMICS      ...      THEORIES



### Environmental benefits

- Climate change mitigation
- Improvement of resource efficiency
- Reduction in fossil fuel dependency
- Reduction of air and water emissions
- Reduction in loss of biodiversity

### Economic benefits

- Improvement in economic growth, productivity and competitiveness
- Accelerated innovation, through correction of market failures in knowledge

### Social benefits

- Reduction of env. induced health problems and risks
- Increased resilience to natural disasters, commodity price volatility economic crises
- Job creation and poverty reduction
- Improved regional equality
- Improved access to environmental services & amenities

# Environmental Economics

- According to environmental economists, environmental issues arise from the inefficient use of natural resources and the undervaluation of natural capital.
- **The underlying assumption is man-made and natural capitals are substitutable by technical solutions.**
- In this perspective, economic development and people's demands do not need to change, and there is optimism about the ability of humankind to solve any problems that may arise concerning resource depletion.
- The economic strategy pursued by environmental economics is to get prices right by putting an accurate value on natural capital. A broad set of potential instruments can be used for the internalization of environmental costs, i.e. command and control, taxes, fiscal transfers, subsidies and market-based instruments such as tradable permits or payments for ecosystem services. Their respective efficiency, effectiveness and legitimacy are discussed differently and vary among circumstances and institutional frameworks.

# Ecological Economics

- In *ecological economics*, the economy is defined as a subsystem of a larger local and global ecosystem which sets limits to the physical growth of the economy.
- **The underlying assumption is ecosystems and natural capital cannot be substituted by technology.**
- Ecological economics discipline attempts to model socio-ecological systems by mapping cause-effect relationships and dynamic processes with the environment.
- Ecological economics applies physical or ecological indicators (e.g. material input per service unit, the ecological footprint, critical natural capital) based on the concept of dematerialisation and the conservation of non-substitutable natural capital are developed (Ekins et al., 2003; Farley, 2008; van den Bergh, 2001).

<b>Term</b>	<b>Short definition</b>
<b>Bioeconomy, bio-based economy</b>	All economic activities that are linked to the development and use of biological products and processes. In Europe, the concept puts a strong emphasis on biomass consumption, innovations, sustainable growth and creation of added-value.
<b>Cleaner production</b>	Cleaner technologies that generate less pollution and waste, and make more efficient use of materials and resources.
<b>Eco-design</b>	Product designed for zero waste production, take-back and reuse, where life-cyclic environmental impacts of a product are considered.
<b>Waste hierarchy approach</b>	Emphasises the minimisation of waste generation. The stages of waste hierarchy are first prevention, then <b>reuse, recycle, recovery</b> and finally disposal.



**Nature-based solutions**

Designing multifunctional landscapes that provide multiple benefits simultaneously such as flood control, carbon storage, raw materials, human health and biodiversity.

**Green infrastructure (GI)**

Planned networks of natural and semi-natural areas which are seen as a cost-effective alternative or complement to grey, man-made infrastructure to satisfy human needs.

**Industrial ecology**

Material and energy flows through industrial systems and interaction with the biosphere. In ideal industrial systems, the use of energy and materials is optimised and the generation of waste is minimised in order to move from linear throughput to closed-loop materials and energy use.

**Circular economy**

*“An industrial economy that is restorative by design, and which mirrors nature in actively enhancing and optimising the systems through which it operates.”*

**Biomimicry**

Imitates designs and processes of nature to innovatively solve human problems.

**Industrial symbiosis (IS)**

Aims at engaging traditionally separate activities in physical exchanges of materials and energy flows. Aims at fostering eco-innovation and encourages networks of organisations to make new investments and change business practices. It also stimulates research and development, new businesses and joint ventures.

**Servicising, functional economy**

The economic objective of the functional economy is “to create the highest possible use of value for the longest time while consuming as few material resources and energy as possible.” The idea of the functional economy is that function is the key to customer satisfaction.

**Material flow analysis (MFA)**

Analysis of the throughput of process chains comprising extraction or harvest, chemical transformation, manufacturing, consumption, recycling and disposal of materials.

<b>Life-cycle assessment (LCA)</b>	A tool for assessing the environmental impacts of a product or service from “cradle to grave.”
<b>Environmentally extended input-output model</b>	Extends the classical input-output model. It describes the interdependencies between different sectors of the economy, including also environmental impacts.
<b>Life cycle costing (LCC)</b>	Measures the total cost of an asset over its life cycle including capital costs, maintenance costs, operating costs and the asset's residual value at the end of its life.
<b>Social life cycle assessment (S-LCA)</b>	Developed for evaluating the social dimension with indicators such as employment, workplace health and equity.
<b>Life cycle sustainability assessment (LCSA)</b>	Integrating environmental, economic and social aspects with the concept of life-cycle assessment.
<b>Cost-benefits analysis (CBA)</b>	A decision support tool to assess the welfare effects of a project or an investment.

## Environmental benefits

- Climate change mitigation
- Improvement of resource efficiency
- Reduction in fossil fuel dependency
- Reduction of air and water emissions
- Reduction in loss of biodiversity

## Economic benefits

- Improvement in economic growth, productivity and competitiveness
- Accelerated innovation, through correction of market failures in knowledge

## Social benefits

- Reduction of env. induced health problems and risks
- Increased resilience to natural disasters, commodity price volatility economic crises
- Job creation and poverty reduction
- Improved regional equality
- Improved access to environmental services & amenities

For further details

► **To cite this version:**

Eléonore Loiseau, L. Saikku, R. Antikainen, N. Droste, B. Hansjürgens, et al.. Green economy and related concepts: an overview. *Journal of Cleaner Production*, Elsevier, 2016, 139, pp.361-371. 10.1016/j.jclepro.2016.08.024 . hal-02604567




**Green economy and related concepts: an overview**

Eléonore Loiseau, L. Saikku, R. Antikainen, N. Droste, B. Hansjürgens, K. Pitkänen, P. Leskinen, P. Kuikman, Maiken Thomsen

PEER Report, 2015  
 Critical Success Factors  
 and Barriers as  
 extracted from Case  
 Studies

<b>Critical factor</b>	<b>Success</b>	<b>Barrier</b>
Economic and market	<ul style="list-style-type: none"> <li>+ Win-win solutions</li> <li>+ External financial support</li> <li>+ Cost-effectiveness</li> <li>+ Decentralised market structures</li> <li>+ New financing mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>- Win-win solutions not always profitable enough</li> <li>- No funding after pilot phase</li> <li>- Poor cost-effectiveness</li> <li>- Unfavourable domestic market conditions</li> </ul>
Technical and R&D	<ul style="list-style-type: none"> <li>+ Technological developments</li> <li>+ Impact assessment</li> </ul>	<ul style="list-style-type: none"> <li>- Remaining technical problems</li> <li>- Methodological difficulties in impact assessment</li> </ul>
Policy and regulation	<ul style="list-style-type: none"> <li>+ Regulatory push and incentives</li> <li>+ Public sector involvement and commitment</li> <li>+ Development of standards</li> <li>+ Strategic development</li> </ul>	<ul style="list-style-type: none"> <li>- Regulatory barriers</li> </ul>
Networks and social capital	<ul style="list-style-type: none"> <li>+ Social capital between stakeholders</li> <li>+ Commitment of stakeholders</li> <li>+ Effective coordination/ leadership</li> <li>+ Positive role of intermediaries</li> <li>+ Relations between actors formalised by contracts</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of leadership</li> <li>- Disciplinary differences</li> </ul>
Public perception	<ul style="list-style-type: none"> <li>+ Green image</li> <li>+ Labels, trademarks and clever product design</li> </ul>	<ul style="list-style-type: none"> <li>- Local resistance and NIMBY conflicts</li> <li>- Negative image of green alternatives</li> </ul>


## 3. Three Important Reports



Towards a  
**GREEN economy**

Pathways to Sustainable Development  
and Poverty Eradication


*A Synthesis for Policy Makers*



**Towards a Green Economy** 2011

# Inclusive Green Growth

The Pathway to Sustainable Development



THE WORLD BANK

2012

## Towards Green Growth: Monitoring Progress OECD Indicators



2011



# Green Economy: three important reports

The concept of the green economy is presented in three reports from leading global organizations:

UNEP's Towards a Green Economy,

World Bank's Inclusive Green Growth

OECD's Towards Green Growth.

All three reports aim to provide a policy framework to help achieve green growth.

All agree that green growth leads to a reduction in greenhouse gas emissions, prevents further environmental degradation and promotes the efficient use of natural resources.

The UNEP report takes these ideas one step further and argues that greening the economy can outpace the current environmentally damaging rate of growth.

These reports also stress the importance of government in creating the enabling conditions for investment to be redirected from activities employing environmentally harmful means to greener industries and businesses

The World Bank argues that short-term interventions (next 5–10 years) are the most important to prevent lock-ins and show immediate benefit to society in the period in which the costs of greening growth are highest and most keenly felt.