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Eco-Innovativeness of the Scandinavian Economies

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Abstract

In the face of the current socio-economic changes in the world, innovations seem to be a kind of solution to many of the pains and problems of the XXI century. Constantly advancing globalization processes, increasing competition and inevitable degradation of the natural environment force countries, economies and societies to be constantly ready to take advantage of emerging opportunities, but also to protect themselves from a multitude of threats. Progressing globalization processes and degradation of the natural environment force a constant response to emerging opportunities and threats. Importantly, consumer awareness is changing, to which manufacturers are also trying to respond, creating eco-innovative products and services. It can be openly stated that the pro-eco-innovative approach and activities of the Scandinavian economies seem to be noteworthy and a model to be followed by other countries in the world. Sweden, Denmark and Finland can boast the highest positions in the rankings of innovation and eco-innovation. For this reason, the aim of the article will be to emphasize the importance of the essence of sustainable development, eco-innovation, on the example of the above-mentioned leaders of eco-innovation.

Keywords: innovations, eco-innovations, sustainable development, Scandinavian economies, Green Innovation Ecosystem Model
Jel codes: O1, O2, O3, O4

1. Introduction

In the face of the current socio-economic changes in the world, innovations seem to be a kind of "idea for a better tomorrow". Constantly advancing globalization processes, increasing competition and inevitable degradation of the natural environment force countries, economies and societies to be constantly ready to take advantage of emerging opportunities, but also to protect themselves from a multitude of threats.

Progressing globalization processes and degradation of the natural environment force a constant response to emerging opportunities and threats. Importantly, consumer awareness is changing, to which manufacturers are also trying to respond, creating eco-innovative products and services.

It can be openly stated that the pro-eco-innovative approach and activities of the Scandinavian economies seem to be noteworthy and a model to be followed by other countries in the world. Sweden, Denmark and Finland can boast the highest positions in the rankings of innovation and eco-innovation.

For this reason, the aim of the article will be to emphasize the importance of the essence of sustainable development, eco-innovation, on the example of the above-mentioned leaders of eco-innovation.

This article is based on a literature review, content analysis, external observation and theoretical modelling, focusing on eco-innovation in Scandinavian economies.

2. Innovation and eco-innovativeness

It is worth starting with the fact that the concept of innovation is explained and considered extremely broadly. What is more, it refers to all spheres of life, from new solutions concerning economic or social life, to new cultural or intellectual trends. Generally speaking, "innovation" means something new and different from the previous solutions. It can also be associated with a necessary change for the better. Therefore, innovation is the introduction of something new, a newly introduced thing, a novelty or a reform. (Prystrom, 2008)

It should be noted that the essence of innovation was focused on by Aristotle himself, who saw innovation as a determinant of the development of social and political conditions. The impact of innovation in the form of technical changes on the economy has been noticed since the eighteenth century and the XIX century. (Pawlik, 2012)

The issue of innovation also appeared in the deliberations of scholars around 400 AD in Old Latin, in ecclesiastical Latin as *innovatio*, meaning renewal - change, and then in the XIII century in French as innovation and Italian: Dante – *innovare*, Machiavelli – *innovatore*. (Marciniak, 2010; Woźniak 2012)

It was only in the works of classical economists – A. Smith and D. Ricardo that innovations began to be treated as an element of economic development. Today it can be said that the concept of innovation is ubiquitous, and thus the range of attempts to define this process is also extremely wide. In the common opinion, J. A. Schumpeter, who at the beginning of the 20th century popularized the theory of innovation, relating it to the economic situation, is perceived as the precursor of the problem of innovation in economic sciences. He presented economic development as a process of positive changes driven by innovation, spread over time. He argued that innovation means a new combination of existing capabilities and has an important developmental function, primarily in relation to the economic state. (Fagerberg, 2006; Prystrom, 2013)

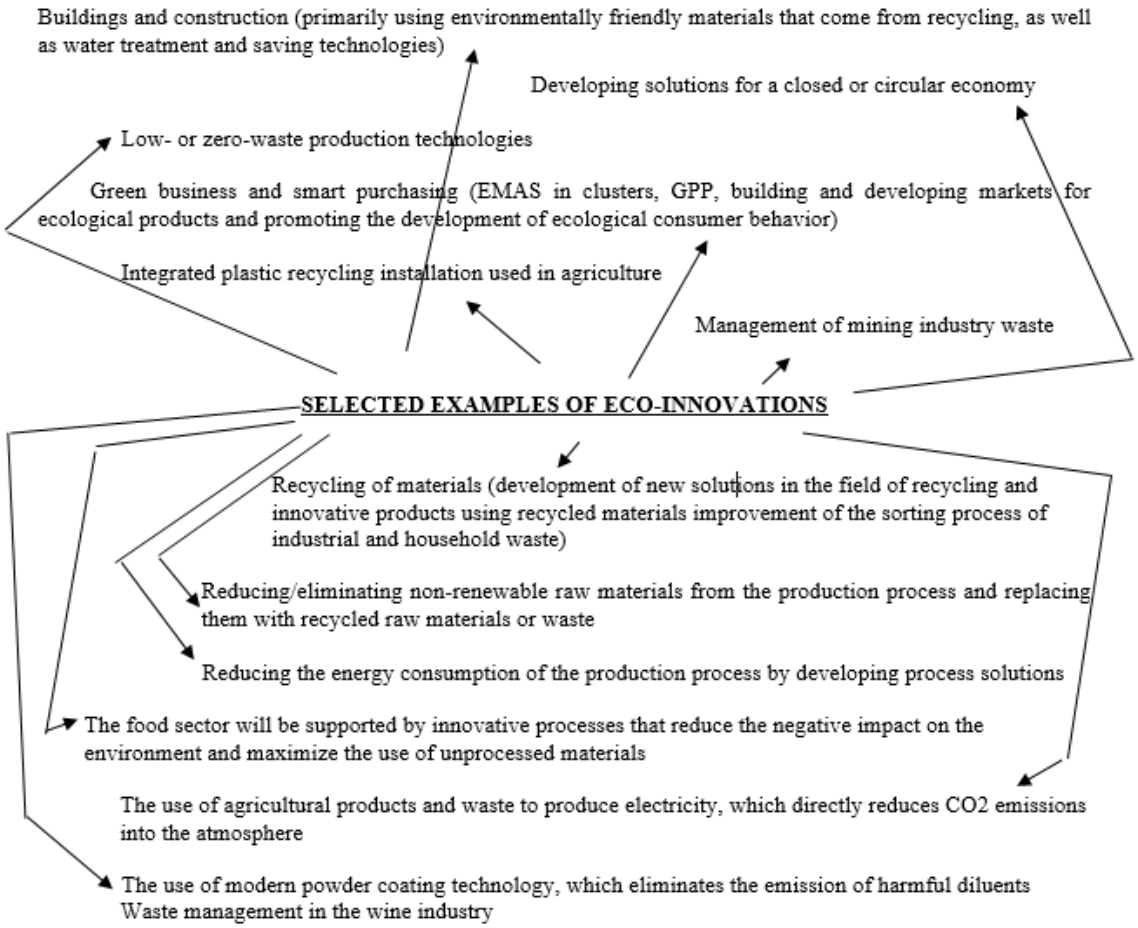

Figure 1. Selected examples of eco-innovations

Source: own elaboration on the basis: Walczyk – Matuszyk K., *Innowacyjne MSP Fundusze na Eko-innowacje w ramach Programu CIP EIP*, Krajowy Punkt Kontaktowy Programów Badawczych UE, Instytut Podstawowych Problemów Techniki, Polska Akademia Nauk, pp. 8, 9,

http://www.kape.gov.pl/iee/docs/konferencja10122008/Sesja_ogolna/10122008_1_KMatuszczyk_.pdf, (access: 19.07.2012); Jabłoński A., *Ekoinnowacje a rozwój nowoczesnego Śląska*, p. 24, 65, 67, http://firma.pi.gov.pl/PARPFiles/file/INNOWACYJNA_FIRMA/KIP/Prezentacje/KIP_A_Jablonski.pdf, (access: 19.07.2012); Talbierz S., *Czym jest ekoinnowacja?*, https://innovatree.pl/czym-jest-ekoinnowacja/, (access: 24.05.2024); http://www.grantyeuropejskie.pl/#ekoinn, (access: 19.08.2008).

In general, eco-innovation is all forms of innovation aimed at visible progress in sustainable development, by reducing environmental impact or achieving greater efficiency and responsibility in the use of resources, including energy. Importantly, eco-innovation is an evolving concept and must therefore be able to respond to change. Eco-innovations also include all modifications in processes and products that reduce their negative impact on the environment. (http://eur-lex.europa.eu/LexUriServ...)

Ecological innovation is also a change in consumption and production patterns and the development of technologies, products and services that reduce the negative impact on the environment. Business and innovation together create sustainable solutions that make better use of valuable resources and reduce the negative impact of the economy on the environment. (*ECO-INNOVATION 2008*-2013 …) Figure 1 presents selected examples of eco-innovation.

Ecological innovations, reducing the impact on the environment, are of great importance in most modern economies, which, striving for further economic development, are aware of the progressive and very often irreversible degradation of the natural environment. One of the many assumptions is the transition to a circular economy and a regenerative economy, achieving the goals of the European Green Deal[1]. Eco-innovations introduced by companies lead to cost reductions, increase the ability to take advantage of new development opportunities and improve their perception by potential customers. For this reason, eco-innovation should be seen as an extremely important instrument for environmental protection that has a positive impact on the economy and society. *(Eko-innowacje w centrum polityki ...)*

Taking the above into account, we can dare to say that eco-innovations can be an idea for a better tomorrow in a constantly developing and caring for nature world.

3. Scandinavian (Eco)Innovation System

Innovations, or more precisely the innovative and eco-innovative capacity of individual economies, are determined by many different factors. The more important of these are the implemented innovation policy and the developed and functioning innovation systems.

The national, also called domestic, innovation system includes institutions of the scientific community, economic entities, organizations of the industrial, service, political and social spheres. It is also a series of organizational, legal, financial and informational connections, and the aforementioned state innovation policy should be a factor streamlining their course. (Ciborowski, 2004)

Further considerations will focus on the Scandinavian region, i.e. countries such as Norway, Sweden, Denmark, Finland and Iceland. As already mentioned in the introduction, the Scandinavian economies are considered world leaders in innovation. The Scandinavian innovation system is widely considered to be one of the most effective and innovative in the world. It can be boldly stated that the Scandinavian countries have achieved high standards in terms of innovation and competitiveness thanks to several key factors:

1. effective education system;
2. investments in green technologies;
3. strong cooperation between public, private and academic sectors;
4. a society with high levels of trust and social awareness;
5. high expenditure on research and development (R&D).

It has been known for a long time that economies based on knowledge and caring for the quality of domestic human capital have better results in terms of innovation capacity and competitive position in the world. This is also the case in Scandinavia, where education is the basis of the local innovation system. Scandinavian education systems emphasize creativity, critical thinking and problem-solving skills, which promotes innovation at every subsequent stage of life. (*Education in Nordic countries* …)

[1] European Green Deal is the European Commission proposals to transform the European Union into a modern, (eco)innovative, resource-efficient and competitive economy and to achieve climate neutrality by 2050.

Scandinavia is a world leader in sustainable innovations, including renewable energy, electric transport and recycling. Scandinavian governments actively support the development of green technologies through regulations, subsidies and tax breaks. (*Nordic sustainability …*)

In this group of countries, there is a culture of close cooperation between businesses, universities and government. This creates synergy effects that accelerate the introduction of new technologies and innovations. (*The Nordic co-operation …*)

Social trust is an important element of the Scandinavia innovation system. Citizens have high trust in public institutions, which enables governments to effectively introduce innovative solutions and programs supporting the development of a knowledge-based economy. (*Social trust …*)

What is more, Scandinavia regularly spends a significant portion of its GDP on R&D. Finland and Sweden are leaders, with significant investments from both government and private sector. (*Public research …*)

Scandinavia is one of the most digitalized parts of the world. These countries are open to adopting new technologies, such as artificial intelligence, the Internet of Things or blockchain, which allows for rapid and wide implementation of innovations and their diffusion. (*Digital …*)

Table 1. Key elements of the success of the Scandinavian eco-innovation model

Element	**Brief description**
Circular economy	The Nordic countries have been promoting a circular economy for years, which involves minimizing waste and using secondary raw materials. Recycling, composting and waste reuse programs are common, and Scandinavia is constantly investing in the development of recycling and waste processing technologies.
Ecological construction	Scandinavia promotes ecological construction, incorporating the principles of energy efficiency, recycling materials and minimizing energy consumption into building designs. Examples include building passive houses that use minimal energy for heating and cooling, and using wood from renewable sources in structures.
Environmental policy and regulations	Scandinavian governments are introducing ambitious environmental regulations that support eco-innovation. High CO_2 taxes, strict environmental standards and financial incentives for green solutions make companies more willing to invest in eco-innovation and society more environmentally aware.
Green energy and decarbonization	The Nordic countries are pioneers in renewable energy. Sweden, Norway and Iceland rely mainly on hydro, wind and geothermal energy, which allows them to reduce CO_2 emissions and build low-carbon economies. Through innovations in renewable energy, the region is working towards eliminating fossil fuels altogether.
Green transport	Transport innovation is a key element of the Nordic approach to eco-innovation. The countries are actively developing infrastructure for electric vehicles and bicycles, investing in charging networks and safe cycle paths. Norway, for example, is the world leader in the number of electric cars per capita, thanks to numerous incentives for buyers.
Innovations in agriculture and food	Scandinavian agriculture focuses on reducing its environmental footprint. The countries are developing technologies that make food production more environmentally friendly, including precision farming, hydroponics, and the production of plant proteins as alternatives to meat.

Investments in research and development of eco-innovations	The high level of research and development funding means that Scandinavian countries are able to develop advanced ecological solutions. Thanks to cooperation between government institutions, universities and private companies, new technologies are being created that can be introduced to the market and exported to other countries.
Social involvement and environmental education	Eco-innovation in Scandinavia is supported by high social involvement and environmental education, which are promoted from an early age. Social awareness of environmental protection is at a high level, which favors the acceptance of new technologies and environmentally friendly solutions.

Source: own elaboration.

In terms of eco-innovation, the Scandinavian system is considered a global exemplar due to its holistic approach to sustainable development and environmental protection. The Sweden, Norway, Finland, Denmark and Iceland have been introducing numerous innovations for years, which aim to minimize the impact on the environment, as well as to transform their economies into more sustainable and climate-neutral economies. The key elements that define the Scandinavian eco-innovation system are presented in table 1.

Thanks to these elements, Scandinavia is able to build an economy based on low emissions, limiting the negative impact on the environment and striving for climate neutrality. The Scandinavian eco-innovation system is an inspiration for many countries that are trying to implement the goals of sustainable development. The Scandinavian eco-innovation model presented in Figure 2 is worth noting.

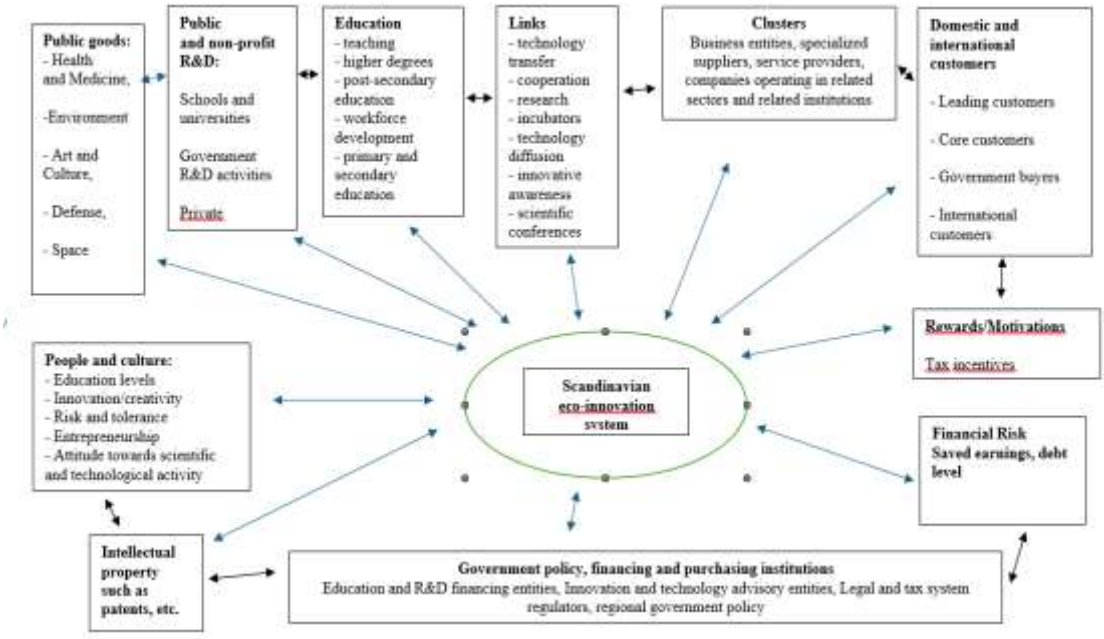

Figure 2 The Scandinavian eco-innovation model

Source: own elaboration.

The Scandinavian model of eco-innovation is therefore the result of both a high level of investment in technology and specific cultural and social factors, based on continuous cooperation between individual components, which ultimately supports the development and implementation of (eco)innovations on a large scale.

4. Eco-innovativeness of Scandinavia

Scandinavian economies are considered to be among the most innovative and eco-innovative in the world. One of the most important is the list prepared by the European Commission. European Eco-Innovation Scoreboard creates a comparative overview of the eco-innovation performance of EU Member States, other European countries and selected third countries. Since 2010 it helps countries assess the relative strengths and weaknesses of their national innovation systems and identify the challenges they are continually trying to address. (*European innovation scoreboard …*)

Table 2. Major eco-innovation rankings of economies

Ranking	Characteristic
Eco-Innovation Index (EII)	It is prepared by the European Environment Agency. It focuses on European Union countries and measures the level of eco-innovation according to criteria such as resource efficiency, development of new technologies, investment in sustainable development and ecological awareness of societies.
Global Innovation Index (GII)	Although this ranking has a broader scope and concerns innovation in various aspects, it includes indicators related to eco-innovation. It measures, among others, the share of patents in environmental technologies or investments in green technologies. It covers over 130 economies and is developed by the World Intellectual Property Organization (WIPO).
Environmental Performance Index (EPI)	Created by Yale University and Columbia University in cooperation with the World Economic Forum. It takes into account indicators related to air quality, water, agriculture, climate change and ecological health. The ranking assesses the effectiveness of environmental actions and is a popular comparative tool.
Green Future Index	It is prepared by MIT Technology Review and measures the readiness of economies to transition to sustainable development and the adoption of green technologies. It takes into account many indicators, such as carbon dioxide emissions, renewable energy and the level of political commitment to environmental action.
Climate Change Performance Index (CCPI)	It is produced by Germanwatch and the NewClimate Institute in cooperation with the Climate Action Network. Focuses on assessing climate change actions, including CO_2 emissions, climate policies and energy transformation.

Source: own elaboration on the basis: *Eco-Innovation Index*, https://composite-indicators.jrc.ec.europa.eu/explorer/explorer/indices/eii/eco-innovation-index, (access: 05.11.2024); *Global Innovation Index*, https://www.wipo.int/web/global-innovation-index/2024/index?utm_source=google&utm_medium=cpc&utm_campaign=Search%3A+Global+Innovation+Index+2024+%28EN%29&gad_source=1&gclid=Cj0KCQiAoae5BhCNARIsADVLzZdPTrdxpoEovxwx2MKpN158O6jiB5ASVYW47vXumeU2hUnqI2APZ0UaAhUXEALw_wcB (access: 05.11.2024); *Environmental Performance Index (EPI)*, https://epi.yale.edu, (access: 05.11.2024); *Green Future Index*, https://ww.technologyreview.com/2023/04/05/1070581/the-green-future-index-2023/ (access: 05.11.2024)

In order to analyse the eco-innovation capacity of the Scandinavian economies, one can rely on eco-innovation rankings of economies, which measure how well individual countries are doing in implementing and developing eco-innovations. More specifically, they examine activities and technologies that reduce the negative impact on the environment and support sustainable development. A summary of the most important rankings is provided in table 2. Table 3 presents a summary of the eco-innovation of the Scandinavian members of the European Union in the perspective of the years 2013 – 2022.

Table 3. Eco-innovation Index of Scandinavian members of the European Union

Country → / Year ↓	Denmark	Finland	Sweden
2022	**3**	**2**	**4**
2021	**3**	**2**	**4**
2020	**3**	**2**	**4**
2019	**4**	**2**	**3**
2018	**4**	**2**	**3**
2017	**4**	**1**	**3**
2016	**4**	**1**	**3**
2015	**3**	**1**	**4**
2014	**3**	**1**	**4**
2013	**3**	**1**	**2**

Source: own elaboration on the basis: *Eco-Innovation - European Commission*, https://green-business.ec.europa.eu/eco-innovation_en, (access: 05.11.2024)

Table 4 presents a classification of the analysed Scandinavian economies in terms of ecological sustainability, which is one of the components of the eco-innovation capacity of national economies. The period 2015-2024 was analyzed, and an average was obtained for the entire period. As a result, it can be seen that Denmark and Sweden are in the best condition in terms of ecological sustainability.

Table 4. Global Innovation Index and ecological sustainability

Country → / Year ↓	Denmark	Finland	Iceland	Norway	Sweden
2024	**18**	**14**	**17**	**6**	**2**
2023	**10**	**18**	**52**	**27**	**21**
2022	**10**	**25**	**65**	**34**	**24**
2021	**11**	**30**	**67**	**20**	**17**
2020	**16**	**25**	**62**	**28**	**15**
2019	**7**	**42**	**58**	**24**	**10**
2018	**10**	**39**	**67**	**35**	**12**
2017	**11**	**34**	**66**	**30**	**20**
2016	**20**	**31**	**75**	**35**	**15**

2015	**17**	**29**	**69**	**31**	**12**
AVERAGE	**13**	**29**	**60**	**27**	**15**

Source: own elaboration on the basis: *Global Innovation Index*, https://www.wipo.int/web/global-innovation-index, (access: 05.11.2024)

The next table (Table 5) is based on the Environmental Performance Index (EPI), which ranks 180 countries on their performance in terms of climate change, environmental health and ecosystem vitality. The list is prepared every two years.

Table 5. Eco-innovativeness of Scandinavia according to the Environmental Performance Index (EPI)

Country → / **Year ↓**	**Denmark**	**Finland**	**Iceland**	**Norway**	**Sweden**
2024	**10**	**4**	**19**	**7**	**5**
2022	**1**	**3**	**10**	**20**	**5**
2020	**1**	**7**	**17**	**9**	**8**
2018	**3**	**10**	**11**	**14**	**5**
2016	**4**	**1**	**2**	**17**	**3**
AVERAGE	**4**	**5**	**12**	**13**	**6**

Source: own elaboration on the basis: *Environmental performance Index*, https:// epi.yale.edu/, (access: 05.11.2024)

Green Future Index classifies economies based on the following five pillars: carbon dioxide emissions, energy transformation, green society, clean innovation and climate policy. This is a young ranking, so far it has only been developed for three years and the group of countries analysed is constantly growing. (table 6)

Table 6 Green Future Index and eco-innovativeness of Scandinavian economies

Country → / **Year ↓**	**Denmark**	**Finland**	**Iceland**	**Norway**	**Sweden**
2023	**4**	**2**	**1**	**3**	**5**
2022	**2**	**6**	**1**	**5**	**9**
2021	**2**	**6**	**1**	**3**	**?**

Source: own elaboration on the basis: *The Green Future Index*, https://www.technologyreview.com, (access: 05.11.2024)

The Climate Change Performance Index (CCPI), is an independent monitoring tool for tracking countries' climate protection performance. Climate Change Performance Index (CCPI) takes into account 14 indicators like Climate Policy - 20% weighting, Energy use - 20% weighting, Renewable Energy - 20% weighting or GHG Emissions - 40% weighting. Due to the fact that there is a problem with the accessibility of previous editions of the ranking, it is possible to analyze the most up-to-date list. It turns out that in 2024 in terms of eco-innovation analyzed by the CCPI ranking, Denmark (4th), Sweden (10th) and Norway (12th) dropped out of the Scandinavian group. (*CCPI ranking …*)

In summary, eco-innovation in individual economies is reflected in different activities. When it comes to eco-innovation in Norway, it aims to become a "low-carbon society" by 2050 by reducing emissions by 80-95% below 1990 levels. Importantly, Norway is also a world leader in the share of electric vehicles, accounting for 56% of vehicles sold in the first half of 2019, or 8% of the national fleet. Furthermore, in June 2019, the Norwegian parliament voted to divest from oil and gas exploration and coal. (Mulhern, 2020)

Scandinavian economies are distinguished by stability, innovation and developed social systems. Countries such as Sweden, Norway, Denmark and Finland place great emphasis on sustainable development, technology and quality of life. In the future, we can expect several key areas to play a special role in their economies:

1. Green energy and renewable technologies - Renewable energy is a priority in Scandinavia. Sweden and Norway already obtain a significant portion of their energy from renewable sources, including hydropower and wind power. The development of hydrogen technologies, energy storage and increasing energy efficiency is a key element of climate policy. (*The European portal for energy …*)
2. Biotechnology and pharmaceutical industry - Scandinavia is home to many innovative biotech companies, especially in Sweden and Denmark. Investments in drug research, new diagnostic methods and biotechnologies, including the production of green materials, synthetic food and personalized medicine, are increasing.
3. Digital technologies and AI - Scandinavia is at the forefront of digitalization and the development of artificial intelligence. This sector includes both advanced digital technologies, such as AI and big data, as well as automation in industry and IT services. Strengthening competences in cybersecurity and developing modern educational systems supporting the learning of new technologies are key. (*AI and Data …*)
4. Circular economy - Nordic countries are investing in solutions that promote waste minimization, recycling and reuse of resources. Circular economy models have huge potential, especially in production, logistics and consumption. This is particularly visible in the fashion and packaging industries, where Scandinavia is promoting ecological alternatives. (*Nordic Circular Economy …*)
5. Smart city and urban mobility - Scandinavian cities such as Copenhagen and Stockholm are already setting standards for sustainable urban living. Future-proof investments include the development of smart cities, the implementation of Internet of Things (IoT) technologies, the expansion of infrastructure for electric transport and autonomous vehicles. (Müller-Eie, Kosmidis, 2023)
6. Marine Technologies - Norway, due to its location, is developing marine technologies, including sustainable fishing, marine energy and ocean resource exploitation technologies. Marine technologies also include the construction of ecological ships and drilling platforms, as well as offshore wind farms. (*Innovation in the Nordic marine …*)
7. Eco-tourism and wellness - Ecological and sustainable tourism, as well as the wellness industry, are growing in the Nordic countries, which are famous for their beautiful landscapes and unique natural resources. The wellness industry offers tourists unique experiences that combine contact with nature, culture and a healthy lifestyle. (*Sustainable travel …)*

At the end of considerations about Scandinavia's eco-innovation, it is worth devoting some attention to the greatest eco-innovations in the world's achievements, which come from this area. (table 7)

Table 7. The greatest eco-innovations in the world's achievements, which come from Scandinavia

Eco-innovation	**Brief characteristics**
CarbFix (Iceland)	Iceland's CarbFix project is one of the world's most advanced examples of carbon capture and storage (CCS). Carbon dioxide is dissolved in water and then pumped into basaltic rocks, where it is transformed into minerals. The project has become a model for other countries, showing how CO_2 can be stored effectively and permanently. (*CarbFix …*)
Northern Lights (Norway)	Norway's Northern Lights project is part of a wider carbon capture and storage programme. Northern Lights is storing CO_2 from heavy and energy industries under the North Sea. It is one of the first large-scale commercial CCS initiatives and is attracting international interest as a model for adaptation in other parts of the world. (*Northern Lights*

	…)
Electromobility and electric cars (Norway)	Norway, thanks to numerous tax breaks and an extensive charging infrastructure, has become a leader in electromobility, with electric cars accounting for over 80% of new registrations. Norway's model for supporting electromobility has become an inspiration for many countries around the world, showing that full electrification of transport is possible. (*Electric vehicles …*)
Bottle and can deposit system (Norway and Sweden)	The deposit systems in Norway and Sweden, which achieve very high return and recycling rates (up to 95%), have become role models worldwide. This ensures that plastic and metal waste is largely recycled, supporting the circular economy and reducing the amount of waste going to landfill. (*Deposit & …*)
Geothermal energy (Iceland)	Iceland, thanks to its geothermal resources, almost completely meets its energy needs from renewable sources. The use of geothermal energy for heating buildings and generating electricity has become an inspiration for other countries. The Icelandic model shows that the appropriate use of local renewable resources can ensure energy self-sufficiency. (*Geothermal …*)
HYBRIT (Sweden)	HYBRIT is a Swedish project that aims to produce steel without using coal, using hydrogen as a reducing agent. This is a breakthrough in the steel industry, which is one of the largest sources of emissions in the world. HYBRIT technology has the potential to significantly reduce emissions from the steel industry and is being watched by countries and industrial concerns around the world. (*HYBRIT …*)
Floating Wind Farms (Norway)	Norway, as one of the leaders in offshore energy, is developing floating wind farms that can operate in deeper waters. Floating turbines allow energy to be obtained in places where traditional wind farms cannot be installed. The Hywind project is one of the first of its kind in the world and has become a model for further investments in floating wind farms in other areas. (*Norway is a global …*)
Industrial and municipal district heating (Denmark)	Denmark can be considered a pioneer in district heating, which is mainly powered by renewable energy and waste heat. These systems enable efficient management of thermal energy in cities and reduction of emissions. The Danish model is being replicated and adapted in many countries as an example of ecological and efficient district heating. (*Regulation and planning …*)
Water and sewage management system (Finland)	Finland has developed advanced technologies in the field of water and sewage management, which enable lower water consumption and minimize pollution. These systems are based on monitoring technology and modern water purification processes. Thanks to them, Finland has become one of the countries with the cleanest water resources. In this way, its water and sewage systems have become a model for other countries. (*Finland 's water …)*
Green buildings and "wooden skyscrapers" (Sweden and Norway)	Scandinavia, especially Norway and Sweden, are developing construction technologies using wood as a key material. In Stockholm, for example, modern so-called "wooden skyscrapers" are being built. These are buildings built entirely of wood, which reduces CO_2 emissions related to the construction. This construction model is enjoying increasing interest in the world as a more ecological alternative to traditional building materials. (*Beautiful and sustainable wooden …*)
Development of energy from biogas and biomass (Sweden and Finland)	Scandinavia is very active in developing technologies using biogas and biomass as an alternative to fossil fuels. A good example is Sweden, which uses biogas in transport. (Berlina, Mikkola, 2017)

Zero-waste cities (Denmark and Sweden)	Scandinavian cities such as Copenhagen and Malmö have adopted advanced zero-waste strategies that aim to minimize waste, promote a circular economy and increase recycling. Through zero-waste initiatives and educational programs, these cities have become role models for other cities around the world that want to reduce their environmental impact. (*How Do We …*)

Source: own elaboration.

Scandinavian economies are developing dynamically and are increasingly focused on areas that support not only economic development but also care for the environment and society. The introduction of these technologies can make them model economies of the future.

Eco-innovation in the Scandinavian economies is a topic that is gaining importance in light of the ever-increasing challenges related to the climate crisis and sustainable development. Taking the above into account, one can dare to mention fhe concept of a "green innovation ecosystem" may seem somewhat innovative. The Green Innovation Ecosystem (GIE) is a concept of integrating various components – from R&D institutions, start-ups to local authorities – that integrate their activities in order to create synergies for eco-innovation. The general assumptions of the green innovation system model are illustrated in Figure 3.

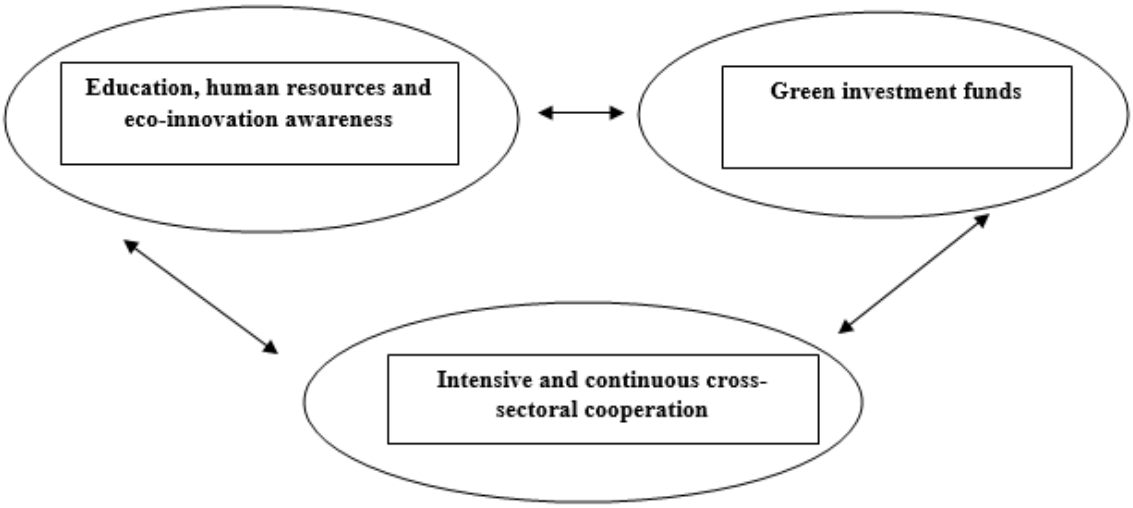

Figure 3 Green Innovation Ecosystem Model

Source: own elaboration.

It is safe to say that GIE is based on three main pillars:

1. Intensive and continuous cross-sectoral cooperation – innovations and their scale are determined by the synergistic connection of different sectors of the economy. An example is IT companies that could cooperate with renewable energy producers, thanks to which eco-innovative solutions could be created that improve the energy efficiency of buildings;

2. Education, human resources and eco-innoavtaion awareness - GIE assumes the creation and updating – appropriate to changing conditions – of educational programs that focus on sustainable development and eco-innovation. Universities and schools could tighten cooperation with industry in order to educate future leaders in the field of green technologies;

3. Green investment funds – the model assumes the creation of funds supporting the financing of innovative ecological projects. The financing could come from public and private sources, promoting the development of not only technology, but also local initiatives.

In order to implement the above assumptions, we could try to create regional eco-innovation hubs, some kind of incubation programs or introduce the circular economy in practice. Each country could create regional eco-innovation hubs, where local startups could cooperate with universities and the public sector to develop innovations focused on local resources and socio-economic needs. Government support should be introduced,

addressed to incubation programs that focus on solutions related to bioeconomy, energy efficiency and the circular economy. In addition, there should be - not only writing in visions, but actually - the introduction of pro-ecological regulations that force companies to apply the principles of the circular economy, while promoting green innovations in the field of recycling and reuse of raw materials.

In short, the Green Innovation Ecosystem in the Scandinavian economies could not only contribute to faster development of eco-innovation, but also become a model for other regions. Based on further cooperation between different sectors, joint investments and education, Scandinavia could strengthen its position as a leader in the field of sustainable development and eco-innovation and become an undisputed role model for other economies.

5. Conclusion

Taking into account the above considerations, eco-innovation of Scandinavian economies is one of the key elements of their ecological and economic policies. Denmark, Finland and Sweden have been distinguished for years as leaders in the field of pro-ecological innovations, especially in the energy sector, waste management, protection of natural resources, sustainable development and circular economy.

Iceland, although it differs from the previously mentioned countries in terms of its innovative capacity, Iceland's eco-innovation distinguishes the country from others thanks to its unique solutions and approach to using natural resources. Iceland, known for its abundance of geothermal and water resources, is intensively developing renewable energy technologies and is striving for a low-emission economy, which allows it to be almost completely independent from fossil fuels.

In turn, Norway’s eco-innovation is an example of how a country rich in fossil fuels, such as oil, can also be a leader in renewable technologies and sustainable development. Norway is investing in clean energy technologies, sustainable transport and research into carbon capture and storage, which contributes to significant reductions in greenhouse gas emissions.

It can be stated that in the face of global challenges related to environmental protection and ongoing climate change, traditional innovation models require continuous transformation. The proposed model of the green innovation ecosystem takes into account three dimensions: ecological, social and economic. Moreover, it integrates sustainable development and eco-innovation in the process of creating new products, services and technologies. The ecological dimension takes into account the product life cycle, analyzing the impact of the product on the environment throughout its life cycle - from obtaining raw materials to disposal, the aspect of waste minimization, implementing the assumptions of the circular economy, including recycling and reuse of materials, which allows for reducing waste and minimizing the negative impact on the environment. The social dimension involves communities, assuming that innovations should take into account the needs of local communities, creating solutions that are adapted to their specifics. It takes into account the culture of sustainable development, emphasizing the strengthening of ecological awareness and social education on sustainable development and eco-innovation. In turn, the economic dimension assumes the development of sustainable business models that are based on ecological values, such as energy efficiency, resource renewables and long-term profitability, financing eco-innovations and exploring the possibilities of financing ecological innovations through sustainable development funds, public investments and public-private partnerships.

The proposed model, which takes into account sustainable development and eco-innovation, is a comprehensive approach to creating modern solutions. Ecological awareness, community involvement and a sustainable economic framework are key elements that build the future of innovation, which are also beneficial to society and the environment. This multi-faceted model can become an inspiration for companies and institutions globally, and especially in regions where sustainable development has already become or is becoming a priority.

What's more, Scandinavia's eco-innovative approach turns out to be a good example to be copied by other economies that, while striving for further economic development, also take into account environmental standards and implement the assumptions of sustainable development, because innovations and the progress associated with them are most desirable, although the good condition of the natural environment determines the further existence of man on Earth...

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