
Decarbonisation of Transport – A Challenge for Inland Navigation

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Abstract:

Purpose: The purpose of the article is to identify the directions of activities conducive to the development of low-carbon inland navigation in the EU with a particular focus on Poland. This goal is being pursued taking into account existing regulations at the EU and national levels.

Design/Methodology/Approach: The article compares selected research results from the fields of inland navigation and low-carbon economy. A method of analysing found data, a comparative analysis using statistical data, and an analysis of the compatibility of regulations at the EU and national levels were used.

Findings: Inland navigation in many countries is undervalued, forgotten and underutilized as an efficient, environmentally friendly means of transportation. The article outlines the formation of transportation policy, the original goal of which was to increase the efficiency of river transportation, stimulate the economy and have a positive impact on the labour market. As the EU's goals have evolved, priorities in the area of transport policy have also changed. There is a growing need to increase eco-efficiency, build intermodal transportation networks, connect systems, or modernize transportation infra- and infostructures. The possibility of integrating Poland's rivers into the TEN-T network is both a challenge and an opportunity for Poland to develop modern, zero-emission inland navigation.

Practical Implications: Inland navigation has lost ground across Europe, but climate challenges call for a return to this mode of transportation as the most environmentally friendly. Therefore, it needs investments in both infra- and infostructure at the EU and member state levels. In addition, Poland should develop a long-term strategy for the development of Inland navigation, taking into account the goals of the green economy.

Originality/Value: The research showed the need for more intensive activities and their coordination at the international, national level, but also the unification of multimodal transportation. The measures taken should lead to a more sustainable, efficient and competitive sector.

Keywords: Decarbonisation, transportation, inland navigation.

JEL Classification: L98, R42, Q27

Paper type: Research paper.

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1. Introduction

Economic development is leading to increasing emissions. Climate change, pollution, and the depletion of traditional energy sources are pushing toward a more efficient and integrated production and transportation system. Therefore, the European Union is working hard to reduce the level of emissions of harmful substances and gases, and supporting, among other things, the development of low-emission transport. Pressure to intensify action in the area of climate and energy policy is mounting, resulting in increasingly ambitious targets for member countries.

The article verifies the compatibility of national and EU documents and points out the need to raise the importance of inland navigation.

2. Literature Review

2.1 Environmental Goals vs. Transport Emissivity

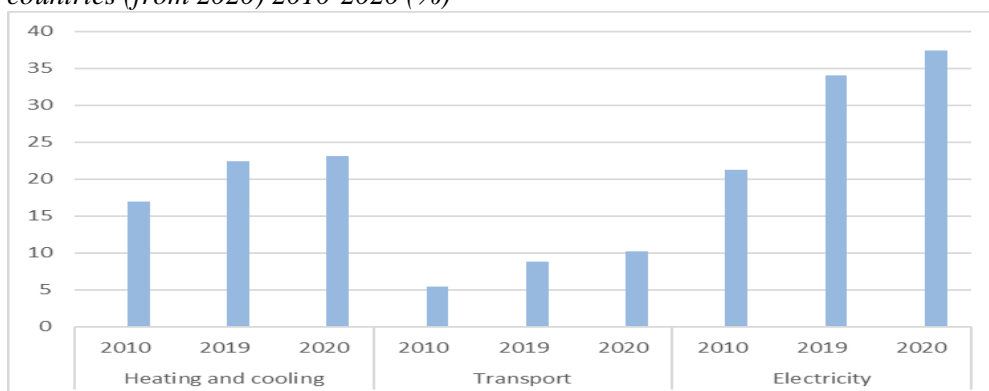
Transportation is essential for the development of economies and economic growth in a liberalized world of trade. At the same time, it generates significant amounts of all CO₂ emissions in Europe. The need for a global energy transition through decarbonisation has emerged in response to ongoing climate change. "The Earth Summit" in Rio de Janeiro (1992) and the Kyoto Protocol (1997) established the international framework for the global climate agenda and began to significantly influence energy issues in the EU. The rank of Community policy was given to energy by the 2009 Treaty of Nice Article 194 TFEU.

The process of applying renewable energy sources does not proceed evenly in the main areas of influence. The fastest changes in the use of renewable energy sources (RES) are occurring in the electricity sector, where the share was 37.5% on average in the EU27 in 2020 compared to 34.1% in 2019, while the slowest changes are occurring in the transportation sector 10.2% in 2020 (Figure 1).

Greenhouse gas emissions in the European Union economy in the third quarter of 2021 increased by 5.7% year over year and reached pre-pandemic levels. Adopted climate commitments impose the need to reduce CO₂ emissions by 2050, which involves achieving so-called carbon neutrality³. In addition to natural ways to reduce CO₂, the EU has introduced solutions that include industry, trade, transportation and other sectors. Reductions in industrial carbon dioxide emissions are taking place thanks to the introduction of the EU Emissions Trading Scheme (ETS). The system is responsible for regulating 40% of the EU's total greenhouse gas emissions. The Union's goal is to reduce emissions to 43% by 2030 compared to 2005.

³*Carbon neutrality, climate neutrality, carbon neutrality, net-zero emissions – is the balance between CO₂ emissions and the absorption of CO₂ from the atmosphere into carbon sinks, i.e. systems that absorb more CO₂ than they emit.*

Figure 1. Share of energy from renewable sources in the European Union – 27 countries (from 2020) 2010-2020 (%)

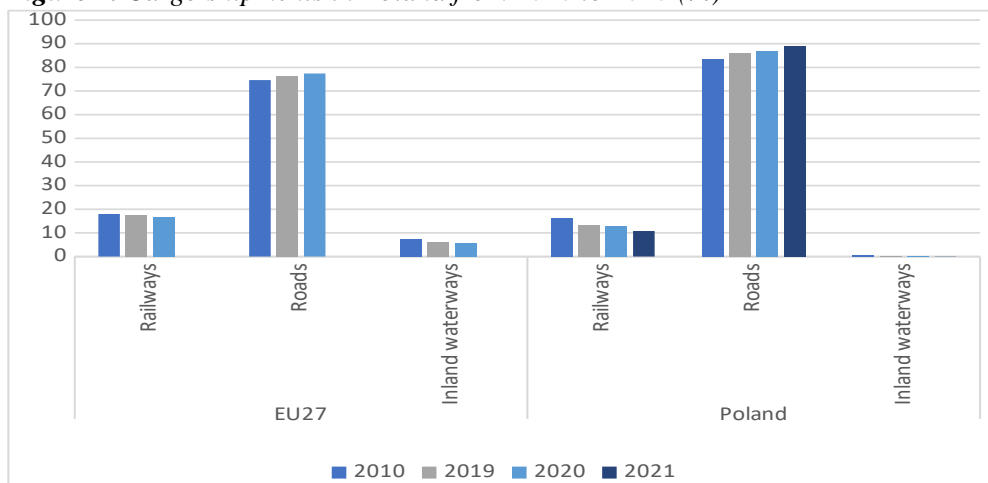


Source: Own work based on Eurostat.

With the ever-increasing role of transportation in economies and the lives of societies, measures are also being taken in this area to reduce emissions. Transportation is responsible for about a third of CO₂ emissions, and of that, about 70% is road transport. To meet the Union's goals, the transport sector must reduce emissions by 90% by 2050. This in turn means that 75% of inland road transport should be shifted to inland navigation and rail. Shipping's efficiency is high, as it uses 17% of the energy required by road transport and twice as much as rail transport per ton of goods carried (EuroPAP News. 2022). This is made possible, among other things, by the fact that waterways often use the power of river currents, thus completely reducing CO₂ emissions.

In its December 2020 Sustainable and Smart Mobility Strategy, the European Commission proposed transforming the EU's transportation system, including increasing the use of inland navigation and short sea shipping by 25% by 2030 and 50% by 2050 (COM, 2020; European Parliament, 2021; European Commission, 2022).

However, it should be emphasized, that the use of inland navigation in Europe is very low, and the trend is declining in favour of an increase in the importance of road transport (the share of shipping in total transport decreased from 7.4% in 2010 to 5.8% in 2020, and the share of rail changed from 18% in 2010 to 16.8% in 2020 in total transport). Poland is experiencing the same trends (a decrease in the share of shipping from 0.4% in 2010 to 0.1% in 2021), but it should be noted that rail use is also lower than in Europe, with a clear downward trend (a decrease in the share of rail in total transportation from 16.1% in 2010 to 10.8% in 2021). Therefore, ultimately, no significant improvement, diversification and growth in the role of inland navigation can be expected. Assuming that Poland meets the EU guidelines, this will mean an increase in the share of inland navigation to about 0.15-0.3%, and in the EU to about 8.7% in 2050 (Figure 2).

Figure 2. Cargo shipments in Poland from 2010 to 2020 (%)

Source: Own work based on GUS (Polish Central Statistical Office).

In June 2021, the European Commission unveiled a program to support European inland navigation called NAIADES III. Compared to its predecessor (NAIADES II), the action plan in Part III (2021-2027) focuses on transforming the EU's transportation systems toward zero emissions and a modal shift. This is to be achieved through the digitalisation of freight transport and logistics, the development of inland waterway infrastructure, including inland ports as multimodal hubs and alternative fuel suppliers (European Commission, 2021).

In July 2021, the European Commission published a set of legislative proposals (the "Fit for 55" package) to align existing EU regulations with climate goals. The changes proposed in the areas of alternative fuels, renewable energy and taxation will have the greatest impact on inland navigation.

Drawing attention to the need to increase the role and use of inland transportation is not a new approach. Back in March 2011, the EC adopted the Transport 2050 strategy, which aimed to create a competitive transportation system to increase mobility, overcome obstacles in key areas and boost growth and employment (European Commission, 2011). Among other things, the document highlights the need to increase the role of water transport (by 2030 30% of freight transported over distances greater than 300 km is to be shifted from road to rail or shipping), using intelligent management systems for waterborne transport – RIS River Information Services System.

However, it can be noted that its role has declined since 2016 in favour of an increased role for road transport. The leaders in inland navigation use in 2020 are invariably the Netherlands (41.6%), Romania (28.6%) and Bulgaria (28.7%). Belgium also stands out above the average (11%), although there has been a weakening in the use of this mode of transportation since 2017. EU countries that

trace-used river transportation between 2005 and 2020, i.e., about 0.1%, are the Czech Republic, Italy and Poland. Countries where this mode of transportation is not used at all (or data is unavailable) are Lithuania, where river transportation accounted for 0.1% in 2008 alone, Estonia, Ireland, Greece, Spain, Cyprus, Latvia, Malta, Portugal, Slovenia (Eurostat database, 2022).

2012 was a breakout year with the highest inland transportation use on average for the EU27 (as of 2020) at 7.4%. Since 2013, the share has successively declined in all member countries, and to date no country has reached the 2012 level of use of this mode of freight transport. In Lithuania and Latvia, more than 50% of the modal share of freight transport is occupied by rail (Eurostat database, 2022).

2.2 Modern Inland Transportation

The digitalisation of inland transportation is not an end in itself, but can be described as a tool to support the achievement of the goals of the European Green Deal, whose overarching goal is to achieve a climate-neutral Europe by 2050. Without digitising the broad area of inland navigation operations, it is impossible to talk about its modernity. This process serves to integrate different modes of transportation and further cooperation with relevant sectors of European economies, which is expected to contribute to safer transportation and a cleaner environment.

The environmental goals have an impact on increasing the importance of inland navigation from the standpoint of reducing traffic congestion, improving safety, lowering emissions and providing a more sustainable transportation system. Inherent in the development of modern inland navigation in Europe is, in addition to investment in infrastructure, especially inland ports, transshipment terminals or reservoirs, support for the digitalisation of inland transportation. This digitisation is taking place on several levels. As part of the River Information Services system, which supports the TEN-T trans-European transport network, the waterways are to be equipped with a vessel traffic management system with the possibility of developing functions for monitoring cargo flows in transport chains.

The European Parliament resolution stresses the need to use data and space services in inland navigation services to create a safer, more sustainable, efficient and competitive sector. Legislative initiatives for smart mobility emphasize that special consideration should be given to the new services of the Galileo and Copernicus programs and the European Geostationary Navigation Overlay Service (EGNOS) (European Parliament, 2021).

In addition, administrative processes previously conducted in analogue are to be digitized. There are also plans to introduce autonomous ships, smart ports, digital interoperability based on intelligent transportation systems, as well as remote-controlled ships and remote-controlled locks. Which will significantly reduce the

cost, and energy intensity, increase the efficiency of transportation, and consequently contribute to better achievement of climate goals.

However, this does not mean that people will become unnecessary, as there is a noticeable strong emphasis on the education of inland navigation personnel, which is due to the fact that human capital is one of the most important resources through which the economic development of the sector is possible (European Parliament, 2021; National Shipping Program to 2030, 2022).

To achieve climate-neutral, resilient and intelligent synchromodal automated transportation by 2050, all modes of transportation must work together. This is especially true of digital transformation and the multimodal approach to it. Inland Navigation Europe has established a common concept for digital transformation and developed a common framework for multimodal data exchange that defines a single goal, a structure (domains and horizons) and 10 principles to achieving it (Table 1). They are intended to serve as a guiding instrument for future digital transportation initiatives, to bring different modes of transportation together and accelerate collaboration with other sectors across Europe (Inland Navigation Europe, 2022).

Table 1. Common multi-modal framework for digitalisation

One goal: climate neutral, resilient, intelligent, automated synchromodal transport in 2050			
3 domains	smart transport	smart logistics	smart admin
3 horizons of innovation			
disruptive	autonomous	automated	automated
new	automated	digitalised	digitalised
incremental	manual=>supported	human=>digitised	paper=>digitised
10 guiding principles			
1. ensure a cross-modal approach		6. assure operational feasibility	
2. invest in both infostructure and infrastructure		7. create a level playing field for small players	
3. guarantee resilience, safety and security of the data exchange		8. ensure shared benefits of data provisioning	
4. monitor data quality		9. technological neutrality	
5. ensure transparency		10. think global	

Source: *Inland navigation Europe, 2021.*

2.3 The Importance of Inland Navigation in Europe and Poland

The development of Western and Central European waterways occurs in close conjunction with the development of seaports. The three largest seaports in Europe can be located quite far from the coast thanks to rivers that allow heavy ship and barge traffic. In 2020, these are respectively: Rotterdam (more than 14 million TEU); Antwerp (12 million TEU) and Hamburg (8.5 million TEU)⁴. The order has not changed for years.

⁴TEU (twenty-foot equivalent unit) – a unit of capacity often used to refer to ports and ships. It is equivalent to the volume of a 20-foot-long container.

The role of Rhine and Main river shipping used to be even greater – in 1970, river shipping in the Netherlands performed more than 60% of the transport work of all transport (GUS. 1987). The importance of shipping in the Danube States has increased in recent years. Total inland navigation shipments in the EU amounted to 131.7 billion tons per km in 2020 – mainly in market segments such as steel, agriculture, food and chemicals (EuroPAP News, 2022).

In few countries has the decline in the importance of inland navigation in the 21st century been as steep as in Poland, although as late as the 1970s a dynamic development of this branch was forecast (Table 2). It is natural to expect that the modernized Oder and Vistula will be a lever for the development of ports in Szczecin, Świnoujście and the Tri-City.

Table 2. *The length of inland waterways in Poland and the volume of transport carried out by these routes*

listing	1980	1990	2000	2010	2020
Cargo shipments in million tons	22.2	14	10.4	5.1	3.9
Length of inland waterways in km	4040	9997	3813	3659	3768

Source: Own work based on GUS (2020) and NIK Supreme Audit Office, (2020).

Where water transport alone cannot be used, combined transport is an opportunity to reduce environmental impacts. The principle in it is to use inland or sea shipping (including rail transport) for distances of more than 100 kilometres in a straight line, and to carry out deliveries to the main mode of transport and to the end customer with the help of road transport (TOGETAIR Report, 2021). From this point of view, a holistic and systemic approach to the modernisation of transport infrastructure in Poland is necessary.

3. Research Results – Challenges for Inland Navigation in Poland

Many years of neglect in the development of inland navigation in Poland means that the cost of restoring or incorporating Polish rivers into the TEN-T network will be very high. Fleet, river infrastructure, infostructure, and a system for informing the public about the importance of inland navigation need to be modernized or built. The energy transition is a challenge for the sector, although shipping is one of the most environmentally friendly modes of transportation. A broad view punishes attention to the role and awareness of contractors throughout the supply chain. Not only inland navigation itself, but the entire inland navigation environment must have convergent goals in understanding the decarbonisation process. The changes undertaken will be facilitated by the continuity of the law and reforms.

In 2021, the first planning document in Poland addressed to the inland navigation sector was submitted for public consultation: National Shipping Program to 2030. Among the program's goals are to increase the use of waterways by business and passenger shipping, integrate inland navigation into the intermodal transport system,

and digitize the sector and decarbonize inland navigation vessels. Investments are to be made on the Oder River Waterway and the Vistula River Waterway (National Shipping Program to 2030 – draft, 2022).

The National Shipping Program (NSP) is in line with key documents according to its authors⁵. However, the project has faced criticism especially from pro-environmental organisations, which have pointed out its incompatibility with the Birds and Habitats Directives. In addition, it has the characteristics of a medium- to short-term strategy, and in the case of inland waterway development in Poland, a document of a long-term nature is necessary, in line with the goals of EU development programs until 2050.

In 2017, Poland ratified the AWI Convention, in which it pledged to unify waterways and integrate them into the European system of waterways of international importance. The waterways in question would be part of the E30 (running along the Oder Waterway connecting the Baltic Sea at Świnoujście with the Danube at Bratislava), the E40 (the Baltic Sea from Gdańsk with the Black Sea at Odessa) and the E70 (connecting the Oder River with the Vistula Lagoon and forming part of the European east-west transportation route connecting Klaipėda with Rotterdam). The implementation of the assumptions will be of great benefit to the development of inland navigation in Poland. It involves reclassification of waterways, especially border waterways, where different countries adopt different classes of the same river, an example being the Oder.

The results of 3 audits conducted by the Supreme Audit Office over a 10-year period are disturbing (NIK, 2014; NIK, 2020; NIK, 2021). They revealed many omissions, delayed and ineffective measures resulting in the stunting of inland navigation development, the regression of this branch of transportation and the failure to achieve the goals of the green economy.

Infrastructure investments in waterways are characterized by high productivity of the expenditures made. That is, the funds invested in the waterway serve not only navigation, but also other important economic functions, among which are the flood control function (flood prevention and flood mitigation), the industrial and municipal function (water intake), the agricultural and forestry function (maintaining proper water-soil relations and irrigating land), the energy function (using the energy of flowing water to produce electricity), the sports and recreation function (recreation

⁵*NSP compliance with: European Agreement on Main Inland Waterways of International Importance (AWI), Regulation no. 1315/2013 of the European Parliament and of the Council of the EU of 11 December 2013 on Union Guidelines for the development of the Trans-European Transport Network, the EU Council document of 3 December 2018 “Inland navigation – recognise its potential and promote it!”, the EC Communication “Towards high-quality inland navigation” NAIADES II, the NAIADES III Action Programme 2021-2027 – inland navigation, the European Green Deal Strategy for Sustainable and Smart Mobility 2050.*

on the water), or the social function (operation of various facilities related to the waterway) (Woś, 2017).

Another aspect of the implementation of the inland navigation policy is the problem of upgrading obsolete fleet. The oldest fleets over 43 years old have, among others Poland and Croatia (about 83%) and Bulgaria (about 72%) (GUS. 2020; GUS. 2021). It would therefore be reasonable to develop a long-term strategy for the reconstruction of the inland navigation fleet, based on the latest developments, with the goal of using low-carbon transportation.

The length of waterways in the Netherlands or Germany is more than 7,000 and more than 5,000 kilometres, respectively, but taking into account the capacity of these waterways, they carry about 70 times more cargo than on Polish waterways.

On the other hand, if we consider the number of retention reservoirs in the context of the possibility of using the water retained in them, which could then be used to irrigate forest and agricultural land, in Poland its capacity (including stored rainwater) oscillates around 6-7%, the rest unproductively drains into the sea (Global Compact Network Poland). By contrast, in Spain, for example, which, like Poland, is facing a hydrological drought, there are 10 times as many retention reservoirs, allowing it to hold at least 40% of the water. This is all the more important because Poland is in the group of countries facing water scarcity (GNCP, 2018), so looking at the need to develop inland navigation from the perspective of global climate change (droughts, floods) also argues in favour of tapping this potential as a least-emission transport.

This publication is an introduction to extensive research aimed at a detailed analysis of the factors determining the development of inland navigation in Poland and identifying good practices in European economies.

4. Conclusions

Inland navigation is the most environmentally friendly and at the same time the safest branch of transport, which, despite years of neglect, has a chance to develop in EU member states, including Poland. The possibility of integrating Poland's rivers into the TEN-T network is both a challenge and an opportunity for Poland to develop modern, zero-emission inland navigation. A challenge to the growth of the role of inland transportation may be the decline in the importance of transporting of raw materials in favour of highly processed goods and the development of the service economy, which tends to favour road transportation.

From the point of view of environmental goals, sustainable development of all modes of transportation is desirable. Moreover, their mutual cooperation is essential to the development of the European transport system and the transfer of a significant

portion of goods from road to water will result in a visible reduction in CO₂ emissions in the long term.

Water transportation faces even greater challenges in terms of decarbonisation in the coming decades. This is due, among other things, the lack of off-the-shelf zero-emission technologies on the market, the long period and high cost of their design, and the long life cycle of watercraft.

As a result of the analysis, the following recommendations can be identified:

- creating a long-term strategy for the development of inland navigation, which would coincide with the EU goals set by 2050. Projects that have a significant impact on the environment, infrastructure, requiring huge financial outlays cannot be considered in the medium or short term.
- reclassification of waterways and expansion of the TEN-T network with new sections of inland waterways to create multimodal transportation hubs.
- modernisation of infra- and infostructure, linked to the expansion of the fleet of modern inland waterways.
- conducting information campaigns among citizens on the benefits of inland waterway development, not only for the national economy, but also for society.

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