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Time to Adapt – Climate Change and the European Water Dimension
Discussion Paper: Inland Waterway Transport

Impacts of climate-driven changes in water resources

Generally, inland waterway transport (IWT) is characterised by a high degree of reliability and safety compared to other transport modes. However, the waterway infrastructure is to some extent shaped and influenced by nature, which makes it susceptible to changes in weather conditions and climate change impacts.

In unregulated rivers or river sections, water level fluctuations already pose temporary challenges under current climatic conditions, since they complicate travel and draught planning and prevent a full utilisation of vessel capacity. In regulated waterways and canals, by contrast, management measures can be taken to ensure navigability, and constraints are only to be expected in extreme cases, for instance extended drought periods and low water flows.

IWT is particularly sensitive to extremes in river flow. In particular, low water levels reduce loading capacity and affect transport prices. This problem may be exacerbated by climate change impacts in the future. To a lesser extent, IWT may suffer from the projected increase in frequency of floods and storm surges, which could temporarily disrupt transport. In addition, changed patterns of sediment transport may be a problem.

In some instances, IWT might also benefit from climate change. In winter, higher temperatures and reduced ice cover on rivers could improve conditions for IWT, and some regions may benefit from increased precipitation.

In general however, the increased variability in climate conditions is likely to lead to more unstable navigability conditions on European unregulated waters and to increased costs of routine infrastructure maintenance (e.g. dredging) and renewal. This might to some extent threaten the reliability of this transport mode in the future.

Sector overview

IWT already plays an important role in Europe today, and shifting more freight transport to water is considered a significant option to improve Europe's transport system as a whole and to deal with constantly growing freight flows. Inland navigation has been shown to be the most environmentally friendly inland transport mode. CO_2 emissions per tonne-kilometre (tkm) are lower than for road and rail transport, and total external costs are currently calculated at 10 EUR/1000 tkm as opposed to 35 EUR for road and 15 EUR for rail transport. Shifting the modal balance of transport towards inland waterway navigation thus contributes to emission reduction and climate change mitigation.

Today the modal share of river transport accounts for 6 % of total inland transport in the European Union. More than 36,000 kilometres of waterways connect hundreds of cities and industrial regions. Of the 25 Member States, 18 have inland waterways, and 10 have an interconnected waterway network.[1] Fluvial transport plays a vital role in transport through the European North-West, while it is of little relevance in most of the Southern Member States.

The existing fleet consists of approx. 11,000 vessels. In 2002, there were more than 7,600 IWT enterprises in the EU 25, which employed 30,900 staff and had a turnover of 4.2 billion Euro. In 2004, 130 billion tonne-kilometres of freight were transported by inland waterways in the EU 25 (European Commission 2005).

[1] http://ec.europa.eu/transport/iw/index_en.htm.

The navigation sector is characterised by a high number of small and medium-sized enterprises (SMEs) and a fragmented market structure. The limited re-investment ability, together with the longevity of vessels, represents a hurdle for the modernisation of the fleet. The institutional framework that governs the sector consists of different regimes at different levels,[2] which poses challenges in terms of co-ordination and ensuring overall effectiveness.[3]

Adaptation options

IWT is driven by long-term investments that cannot be easily relocated, redesigned or reconstructed. Thus, there is a need to be forward looking and to consider the longer term future. The following section provides examples of current practices, innovations and potential adaptations that may reduce vulnerability related to climate change:

- **Adapting waterway infrastructure and management of waterways:** The objective of such measures is to stabilise the flow regimes in rivers with a view to climate change impacts in order to secure travel. Where possible, fluctuations of water levels may be smoothed out through the appropriate management of dams and reservoirs. In other cases, investment measures such as the construction or adjustment of locks and weirs, harbour infrastructure, and straightening and deepening of waterways may be an option. In canal systems, water transfers may help to respond to regional water shortages under certain conditions.

  However, such measures have to be reconciled with environmental protection concerns, and the effectiveness of adaptation measures has to be carefully assessed. Also, it should be ensured that infrastructure projects undertaken for other purposes do not exacerbate problems caused by climate change. For example, the deepening of rivers or canals may lead to more rapid runoff, which might even accelerate the falling of water levels during dry periods. Similarly, straightening of waterways may increase the risk of flooding.

  Generally, potential adaptation measures for IWT would have to be co-ordinated with integrated river basin management efforts under the Water Framework Directive (WFD) and the Floods Directive. An integrated river basin management approach to co-ordinate the different interests will be crucial.

- **Adapting ship design:** As shown above, the capability of infrastructure development to accommodate ever larger ships and at the same time buffer temporarily decreasing water levels may be limited. Therefore, ship design may also need to respond to the challenge by adapting vessels to the available waterways and waterway conditions. The current trend towards increasing size and decreasing number of ships may not be sustainable under changing climatic and water flow conditions. Given the long lifetime of vessels, investments in fleet modernisation and shipbuilding should not be undertaken today without consideration of climate change trends.

  Technological innovation may improve the carrying capacity at low water levels, for instance by reducing ship weight and thus draught. There is a large potential for innovative win-win solutions in ship design by better adapting it to changed climatic conditions and to improve competitive and environmental performances of vessels.

  Adapting logistics and information systems: Under more unpredictable climatic conditions, IWT would also benefit from prompter and more precise information on actual conditions and water level forecasts. New information systems and satellite supported navigation can provide such information.

  The existing trend towards an increase in the share of direct transhipment and the substitution of storage of goods near production sites may have to be reversed. Bottlenecks will increasingly be caused by variability in water flow conditions, so that industry customers who receive raw material via waterways will have to build storage for their goods in order to avoid delivery delays. New logistic processes, more flexible transport chains and integration with different transport modes may also help (Hönemann 2006).

[2] EC/EU, Central Commission for Navigation on the Rhine, Danube Commission, UNECE, European Conference of Ministers of Transport.

[3] EU press release IP/06/48: European Commission sets out ambitious action program to boost Inland Waterway Transport. 17 January 2006.

Adaptation under the existing EU policy framework

In the context of an entirely deregulated inland navigation market since 1 January 2000 (Directive 96/75/EC),[4] the European Commission aims to promote and strengthen the competitive position of IWT, and to facilitate its integration into the intermodal logistic chain (European Commission 2001). The Commission wants to encourage companies to use IWT in order to increase the sustainability of the transport system.

In January 2006 the Commission adopted a Communication specifically on the promotion of IWT (**Navigation And Inland Waterway Action and Development in Europe – NAIADES**; European Commission 2006a). The communication is addressed to the European Community, Member States and the inland navigation industry, and it recommends legislative, co-ordinative and financial support measures that should be implemented in co-operation with national and regional authorities, River Commissions and the industry. While IWT's contribution to climate change mitigation is an issue in EU policy documents, they **currently do not address adaptation to changing climatic conditions** as a specific challenge.

However, there is an opportunity to incorporate adaptation efforts (see above) under the NAIADES action programme. The action programme covers the period 2006-2013 and focuses on five strategic areas:

1) creation of favourable conditions for services and new markets,
2) modernisation of the fleet,
3) jobs and skills,
4) improving the sector's image, and
5) waterway infrastructure.

Two of these strategic areas, namely fleet modernisation and infrastructure, are relevant in the context of adaptation. The NAIADES programme furthermore highlights the importance of River Information Services (RIS), which may also be supportive to adaptation efforts.

Modernising the fleet

The **objective** is to improve logistics efficiency, environmental and safety performance of IWT. The NAIADES working paper (European Commission 2006b) mentions that particular attention should be paid to vessels operating under extreme circumstances (e.g. low water depths) and that vessels may be adapted to the conditions of particular rivers. **Instruments** proposed for this action focus on financial support (national support programmes, EU RTD and support programmes, state aid guidelines for support schemes). The set-up of an innovation fund is proposed that should support innovative concepts and encourage the modernisation of the vessel fleet.

Infrastructure

The **objective** is to support and provide guidance at European level for the improvement of European inland waterway networks. The main concern is the maintenance/improvement of infrastructure and elimination of bottlenecks e.g. from limited width and depth of rivers and canals, bridge clearance and lock dimensions. Furthermore, maintenance and upgrading of existing structures is relevant in the context of climate change adaptation. These issues might be included into the envisioned **European Development Plan** to support and guide the improvement of the European inland waterway infrastructure and transhipment facilities at European level. The plan should provide guidance to Member States, for instance with regard to the definition of standards for waterway width and depth. It should also prioritise required investments, ensure a regular examination of the condition of Europe's waterway network, and ensure co-ordination with river basin management plans under the Water Framework Directive.

The latter issue is currently subject of an ongoing debate on the EU level as conflicts of interest may arise due to the fact that the WFD strongly emphasises the quality of hydro-morphological conditions while navigation infrastructures often require major hydro-morphological changes. As a preliminary result of the debate, the Strategic Steering Group "WFD and Hydro-morphology" under the WFD Common Implementation Strategy points out the necessity to integrate and reconcile the objectives of relevant sectoral policies by enhancing the recognition of the different interests, fostering the co-operation between the different competent authorities and stakeholders, and promoting more integrated

[4] Council Directive 96/75/EC of 19 November 1996 on the systems of chartering and pricing in national and international inland waterway transport in the Community and others.

development strategies (CIS-WFD 2006a). In the WFD context, infrastructure development will not only have to investigate and apply good practice but may also need to develop alternatives to traditional solutions in order to avoid deterioration and to ensure that measures are compatible with ecological objectives.

To **finance** infrastructure improvement and maintenance, the European Commission proposes EU RTD and support programmes (FP7, PHARE, ISPA, CARDS, INTERREG), national funding schemes and TEN-T (Trans-European Transport Networks).[5] Furthermore, the Commission calls for a gradual charging for the use of infrastructure and a price structure that reflects the costs (including external costs) to the community. It should be noted that **infrastructure charging** that allows external costs, especially environmental costs, to be internalised in the price of transport could be used to cover also the cost for adaptation measures for climate change.

River Information Services

River Information Services (RIS) projects support traffic and transport management in inland navigation based on information technology and telecommunication. In 2005, RIS was established under EU Directive2005/44/EC (RIS Directive)[6] laying the ground for the establishment of a pan-European information network. The Directive aims to ensure compatibility and interoperability between existing and new RIS systems. An infrastructure project fostering the RIS implementation in Europe is envisioned within the Trans European Networks for Transport. Systems that ensure rapid and efficient information exchange between all actors involved in waterway transport may serve as important tools in dealing with the challenges posed to IWT by changing climate conditions. For instance, the RIS Directive requires Member States to ensure that notices to skippers on waterway conditions, including water level or maximum allowable draught, are provided as standardised messages.

Conclusions and key issues

Navigation on inland waters is **sensitive** to changes in discharge and water levels especially with regard to long-lasting low flow conditions. Therefore, **adaptation to climate-induced changes should be taken into account as one of several challenges for long-term IWT management and planning**. The work of different actors (meteorologists, hydrologists, waterway managers ship builders, IWT customers) may contribute to improving the knowledge base and to developing effective adaptation strategies. More information on the vulnerability of the inland waterway transport sector and the magnitude of climate change impacts is necessary in order to devise adequate adaptation measures. Adaptation should be taken into account in national and EU waterway transport policies in order to encourage and support adaptive efforts at lower administrative levels and by private actors.

The European Commission has clearly expressed its view to promote and strengthen the competitive position of the inland waterway transport in the transport system as an important issue for mitigating climate change (reduce CO_2 emissions). There is scope to include adaptation concerns into some of the measures recommended by the **NAIADES communication**. In particular, support of infrastructure or fleet modernisation through **financial instruments** might be made conditional on the long-term sustainability of planned investments in the context of changing climate and water resource conditions. Financial instruments to foster adaptation are important for adaptation strategies and should form a key issue of debates.

Inland waterway management strongly interacts with **river basin management** and the **implementation of the WFD, flood protection** and **coastal zone management**. Close co-operation between actors and stakeholders is needed to integrate economic, social and environmental objectives.

Key questions

1. **Impacts and vulnerability**: What impacts are to be expected from climate change in individual river basins and river stretches with respect to inland waterway transport? How do they vary in time and season?
2. **Adaptation options**: Which adaptation options are available to the sector? Which

[5] Currently two projects are funded: Project No. 18: Rhine/Meuse–Main–Danube inland waterway axis; Project No. 30: Inland waterway Seine–Scheldt.

[6] Directive 2005/44/EC of the European Parliament and of the Council of 7 September 2005 on harmonised river information services (RIS) on inland waterways in the Community, Official Journal L 255 , 30/09/2005 p. 152 – 159.

of them are most feasible, effective and cost-efficient?

3. **Policy action**: What could be gained from co-ordinating and implementing adaptation at EU level? How could EU policies support adaptation in the inland waterway transport sector?
4. **Integrated approach**: What role should the IWT sector play in an integrated adaptation effort at river basin level? Where might possible adaptation measures conflict with other interests such as WFD implementation or flood protection? How could such conflicts be resolved?
5. **Research needs**: Which knowledge gaps need to be addressed for the sector with regard to impacts, vulnerability and adaptation options?

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