INLAND WATERWAYS AND SUSTAINABILITY [1]

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UNDERSTANDING THE CHALLENGE OF SUSTAINABILITY

The term *sustainable development*, even more *sustainable mobility* is frequently misused, and sometimes employed as if it were the economic growth or the increase of the mobility that should be sustained. Here we underline that the adjective *sustainable* has to narrow the sense of development (or mobility); appointing those conditions, within which the development (mobility) can at all be allowed. So a first statement is that *sustainable development is not equal to the non-sustainable development plus environmental measurements*.

There is a debate even within scientific followers of the idea of sustainability. A key question is whether (and how much extent) natural capital can be substituted by man-made capital. *Weak sustainability* supposes that this is possible in the long run, and that it is enough to make sure that the sum of those capitals are not diminishing.

Here we use the *strong sustainability* definition (*Neumayer* 2003, *Ott* 2003) as a frame of our approach: that is *society* and *environment* are not just equal pillars of sustainability beside the *economy*, but we also suppose that there is a hierarchy between those pillars. The subsistence of non substitutable basic environmental goods are so decisive for any future existence (because they cannot be duplicated by manufactured capital), that the maintenance of them as an operating system must be managed as a condition. This means that society and economy has to accept environ-

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mental conditions and their development has to be fulfilled within given limits, otherwise we may hurt the integrity of the life-supporting system of the earth.

The widely accepted main Daly principles (Daly, 1991) help understanding the systemic boundaries. Our *input* from the nature, that is the pace of the use of the resources must be slower than the reproduction rate of those resources, and similarly our *output*, that is the emission of different materials (waste) must be smaller, than the absorption capacity of the nature. (Here we omit presenting further principles that make easier a transition from the non-sustainable position to the sustainable one.)

Above principles describe the *external conditions* of the sustainable operation. One can easily understand them, but this is not enough for the suitable operation. There is a next, *internal condition* too that our systems could percept those existing boundaries, and *be able to operate within the recognised limits*.

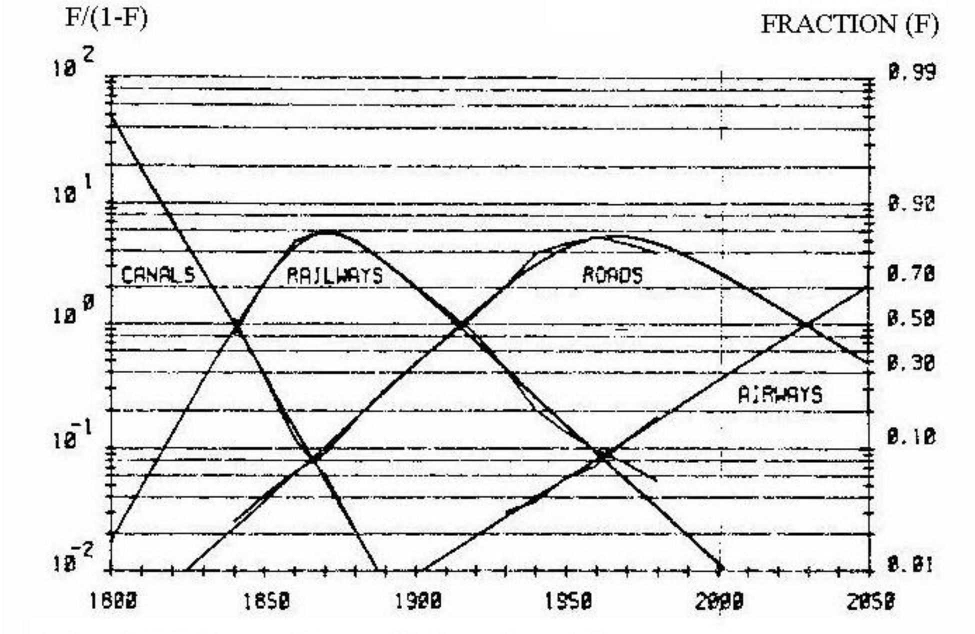
The biggest challenge of our systems is to alter the formal operation so that they become sensitive to the (changing) external boundaries, and adaptive to the necessary changes. This is a main lesson of the sustainability, lesson of the climate change, – but also the lesson of social sensitivity, user centeredness etc.

In the case of the transport, the traditional way of planning was the forecast of the future demands, and optimising a network and operation according to those demands. This whole process has been challenged by now, when *the main task is to assure those networks, where the operation can easily adapt itself to the changing (not yet quite preview) external circumstances*.

INLAND WATERWAYS WITHIN THE TRANSPORT SYSTEMS

Until the middle of the 19th century waterways were the main carriers of long-distance terrestrial(!) goods transport – the alternative was the animal-driven cart. Even on the rivers in the case of the upstream transport the human or animal haulage was prevalent.

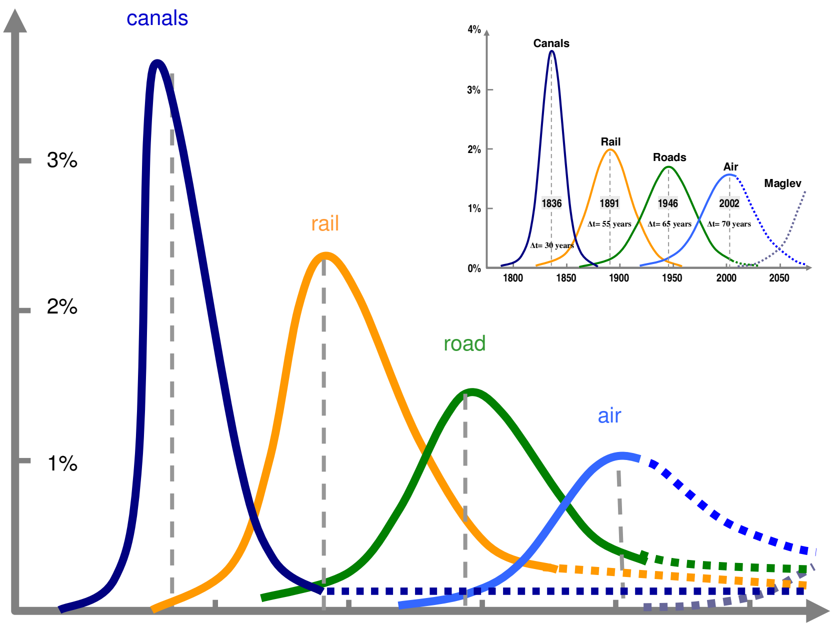
The rail, the paved road, the automobile and the airplane all appeared as *new technical inventions*, and possibilities to take over the load from the previous actor. In the history of the past two centuries of the transport there was always a (time-to-time changing) *dominant transport mode*, and accordingly a dominant infrastructure (*Nakicenovic* 1988; *Figure 1*)



Source: Nakicenovic 1988

Figure 1. Substitution of transport infrastructures in the USA 1800-2050 (Fraction of the given mode in length of the network relative to the others)

Regarding not the proportion of modes relative to each other, but the process of the growth of the infrastructure network of different transport modes, Ausubel et al (1998) manifested that those modes coming later dispose with longer development period and more and more moderated dominance relative to the other modes. *(Figure 2.)* Based on those results, we added a hypothesis, that the earlier ("outmoded") transport modes not necessarily have to totally finish their cycle of development, rather stabilising it at a lower level. From such a hypothesis by the 21st century a mixture of modes evolved, where each transport mode may have a given share from the total transport, without the sharp domination of a specific one competing with the others. We see that such an approach also suit to a post-modern paradigm, where a mixture of the existing heritage can be well coupled with new innovations, and the technology is used just to achieve the good amalgamation of the different segments. The task of the transport policy here is to promote the cooperation of the different modes in an integrated, co-modal transport system.



Source: Based on Rodrigue (1997-2006) who reproduced after Ausubel et al (1998)

Figure 2. Mixture of modes in the 21st century. Based on the Growth of the US transport system, 19th - 21st century (right upper corner)

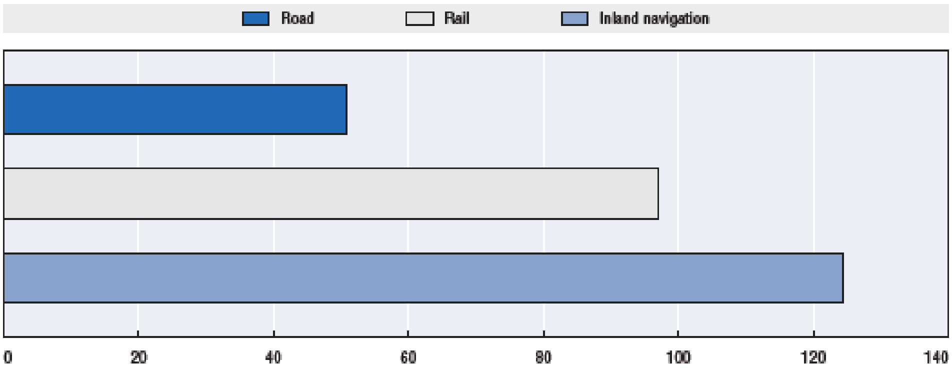
INLAND WATERWAYS: FIGHT FOR A BIGGER SHARE BASED ON UNCERTAIN STATISTICS

Present-day situation is totally different from those described above. Even the modes in a weaker position try fighting against the other modes, and achieving a traffic gain at the expense of those other modes, supposing a 0-sum game in the transport market, where the *modal growth* is an accepted target.

That is why a great portion of the existing background papers dealing with the *inland waterways* offer unbalanced argumentations for catching a bigger share in the transport market, without an extended analysis of either the integrated transport situation or the sustainability targets.

There are sustainability boundaries (pressure for less energy use, need of less emission output) that are really favourable for the rail and the navigation, and unfavourable for the air and road transport. Railways and waterways together should form those integrated transport segments that could offer transport policy level solutions for sustainability problems. If rail and water tries to rival for the goods instead, they both may miss those potential advantages coming from the integration, and also a loser in the game the whole economy that is obliged to construct parallel capacities instead of integrated solutions.

The non-confirmed arguments that try to improve the positions of the inland waterways against the rail can appear even in official DG-TREN positions, using uncontrolled numbers. The main page of the inland waterways writes: “Its energy consumption per km/ton of transported goods is approximately 17% of that of road transport and 50% of rail transport”. (Inland waterway transport DG-TREN). *Piekarski* 2006 also refers to EC documents (Inland Waterway Freight Transport 2003) writing: “European Commission studies indicate that with only one litre of fuel most vessels can transport one tonne of cargo over 127 km, in comparison to 97 for rail and 50 for road.”. (Inland Waterway Freight Transport EC 2003)



Source: www.inlandnavigation.org

Figure 3. Energy use for moving tonnes per km

It is not easy to find those sources that can support these proportions with real numbers. Those international statistics publishing county level final energy consumption data by transport mode, (Eurostat, UNECE etc.) can’t distinguish the energy used for freight, so, first of all rail and road statistics say nothing on energy consumption per km/ton. To find data it is necessary to see single researches.

In Hungary the specific energy consumption of the water freight was really half of the rail until 1990. (cca 150 KJ pro km/ton versus 300 KJ pro km/ton; *Fleischer* 1999). In that period the official statistics contained five times more km/ton marine transport performance than inland navigation. During the next five years the Hungarian state got rid of the Hungarian flag marine fleet, and by 1994 when the statistics related clearly to the inland navigation, the energy consumption of the water freight changed to 600 KJ pro km/ton – much worse than the rail that held the 300 KJ pro km/ton value.

More extended and more recent comparison was made by *McKinnon* (2007) in the UK. He measured CO_2 emission rather than fuel consumption, and .found the average CO_2-intensity for railfreight operations in the UK was 14.5 gms CO_2 per ton/km. This result was lower than other results he also surveyed and compared.[2] The emission depends to a great extent on the haulage and can be summarised as 15-20 gms CO_2 per ton/km in the case of electric haulage and 35-40 gms CO_2 per ton/km at diesel haulage. In the same time the freight on inland waterways emits 30-40 gms of CO_2 per ton/km (Dings and Dijkstra, 1997, INFRAS/WWW, 2004). As an average there is no difference between the specific emission of the rail diesel and the inland navigation, while the rail is better if using electric haulage. McKinnon summarised the average emission intensity for different modes as follows: air freight 1600, vans 220, heavy trucks (>38 tons) 160, IWW 35 coastal shipping 25-30, rail 20 gms of CO_2 per ton/km.

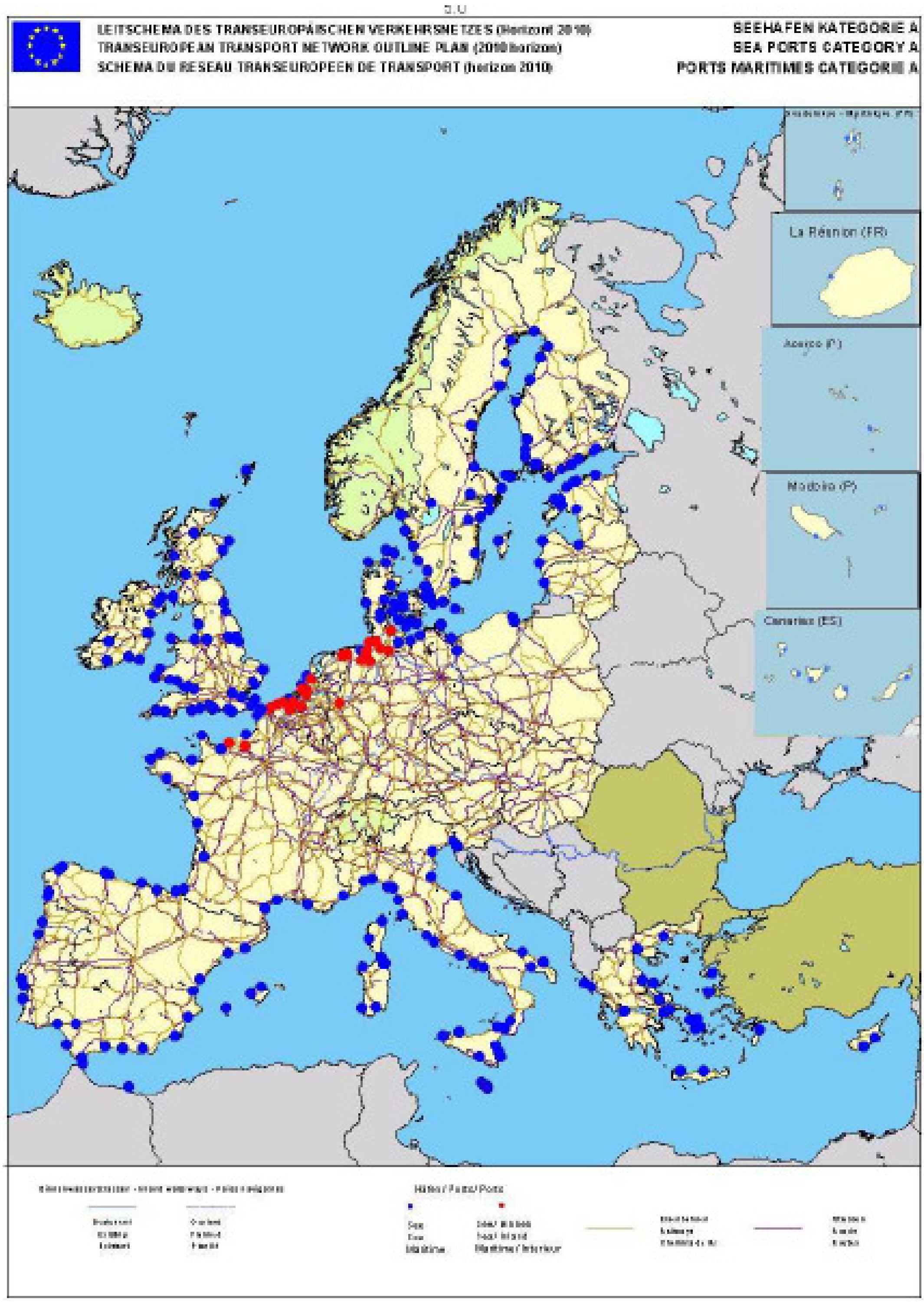
We don't have to accept above results as that of generalisable for the rest of Europe, but we can confirm the hypothesis that *there is no difference in fuel intensity and in CO_2 emission intensity between the rail and the inland navigation*, while they both represent a relative good performance within the transportation.

INLAND WATERWAYS: ARE THERE WESTERN PATTERNS TO FOLLOW?

Besides the fuel-consumption and emission arguments, there is another frequent argument for the development of the share of the inland navigation in freight transportation, namely the example of countries, where this proportion is much bigger. There are different statistics, (pipelines included or not, tonnes or tonne-kms etc.) here we use the Eurostat 2009 statistics for the year 2006. By that basis the share of the inland waterways freight transport performance (tonnekm) within the total freight performance was 5,6 % for the EU-27s; while the same share for the EU-15s was 6,5 %.(Eurostat 2007) In Hungary the same number was 4,5 % in that year.

Does this mean that Hungary is lagging behind Europe, or that the new members have to catch up with the EU-15s in inland navigation? If we study how that 6,5 % was split between the countries of the EU-15, we can find the three leader countries of the EU-15 (Netherlands 32,3 %, Belgium 14,7 % and Germany 12,8 %) – while all other EU-15 countries have smaller inland water freight proportion than the EU-27 average or even than the Hungarian share. In the eastern side there is also one country, Romania with 10 % as leader in navigation.

[2] „For example, the Rail Emissions Model constructed by AEA Technology (2001) for the SRA used a ratio of 20 gm of CO2 per tonne-km for railfreight. The TREMOVE study, undertaken by the University of Leuven, assigns a value of 33 gm of CO2 per tonne-km for UK railfreight operations. Four other recent studies by NTM (2005), WRI-WBCSD (2003), INFRAS (2004) and IFEU (2005) suggest average ratios for European railfreight operations of, respectively, 17, 30, 38 and 18 (electric) / 35 (diesel) gms / tonne-km." (McKinnon 2007)



Source TEN-T Sea ports http://ec.europa.eu/ten/transport/maps/doc/schema/seaports/2003_accession_seaports_cat_a_eu25.pdf

Figure 4. First category sea ports and sea/inland ports in Europe

What is the common character of those leaders? All of them are maritime countries, also with important river mouths. As for the western three, they also dispose of old canal systems parallel to the sea-shore between the rivers, forming a network of waterways (generally from the early 19^{th} century on). Looking at the ports (TEN-T seaports 2003) there is also a distinction between sea-ports and sea/inland ports, as especially in the case of the three countries the big ports are far into the continent, in the horn-mouths of the rivers. (*Figure 4*). In the case of Romania the situation is different, the Danube has a delta mouth, not offering a good sea port, instead Constanta grew to a big Black Sea port, and it was recently linked to the Danube with a canal.

Even on the Rhine, there is a ten times difference between the navigation performance of the river-mouth and a cross-section 700 km upstream. There is also a difference what economic navigation means depending on different shapes of river cross-sections. On narrow and deep rivers a different fleet evolved, than on the wide and shallow eastern European rivers.

Cheap water freight means, that if the goods are in the well loaded barge, the movement of the goods is cheap. If the fleet and the river-bed is different, or the fleet and the ports are missing, or if there is no market for those goods – the cheap transport has no meaning any more, until all those conditions are created.

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Here we can turn back to the sustainability background. On the one side sustainability means that we have to be able to accept that we need to adapt our activity to the endowments, we can't keep our previous plan at any price. On the other side sustainability really offers a good opportunity to the low-emission transport modes as rail and waterborne transport, but it needs an integrated policy approach to implement new measurements for promoting those modes. It is not enough to refer to this argument, and behind that trying to pass old, outmoded plans in favour of an old and outmoded transport model.

There exist already good surveys to support a more detailed analysis. It is not enough to sell wishful thinking as traffic forecasts (*Holger*, ECMT 2006). It is not enough to deny emissions coming from waterborne transport for showing a better comparison (*Corbett–Fischbeck* 2000). It is necessary to study not only the advantages, but also the weaknesses of inland waterways, (a good example is *Pickarski* ECMT 2006) because it is not against the other modes, but along the possibilities of the rail- and waterways that a positive scenario can be constructed for the future transport policies.

SUMMARY AND CONCLUSION

The paper proceed from the definition of *strong sustainability*, where environmental constrains are to be taken seriously. Beyond the external conditions (that relates the limits of inputs from and outputs to nature) there are also internal conditions of sustainability: that allow man-made systems to perceive and observe those limits. The necessity of the adaptation to changing endowments brings an essential new orientation into the relations to the future.

The different documents promoting the development of the inland navigation are all count on the limitation of the future resource use and emission, but rarely draw more conclusion, than that it is favourable for the inland navigation. The paper attract attention to the fact that the myths of the low energy use and the low emission of inland waterways is not proven in the practices, and an integration rather that a competition with rail would promise more result for the future.

Proposals that try to show countries with high share of inland waterway fright as quantitative examples to follow to other countries are also false. Those countries all dispose with special endowments and old traditions of navigation that can't be copied by land-locked countries or countries with different background. In that context the adaptation to the environmental endowment is also a good point of orientation.

The sustainability approach can really offer a good possibility for the development of the inland waterways, but this transport mode can gain from it only in conforming itself to an integrated transport policy frame, and in close cooperation with other modes instead of competing against them.

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