Sustainable Approach to Inland Freight Transportation
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ABSTRACT

Sustainability is the ability to exist constantly. In the 21st century, it refers generally to the capacity for the biosphere and human civilization to co-exist. It is also defined as the process of people maintaining change in a homeostasis balanced environment, in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. In this paper we discuss about the economic, social and environmental impacts of freight transportation. Also we discuss about the constraints within the implementation of inland water transportation as it is the most sustainable form.

Keywords : Economic, Social and Environmental Impacts, Human Civilization, Biosphere

I. INTRODUCTION

Sustainability is the ability to exist constantly. In the 21st century, it refers generally to the capacity for the biosphere and human civilization to co-exist. It is also defined as the process of people maintaining change in a homeostasis balanced environment, in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainability can also be defined as a socio-ecological process characterized by the pursuit of a common ideal. An ideal is by definition unattainable in a given time and space. There are mainly three pillars of sustainability and they are:

- Society
- Economy
- Environment

Sustainable transport refers to the broad subject of transport that is sustainable in the senses of social, environmental and climate impacts. Components for evaluating sustainability include the particular vehicles used for road, water or air transport; the source of energy; and the infrastructure used to accommodate the transport. Transportation operations and logistics as well as transit-oriented development are also involved in evaluation. Transportation
sustainability is largely being measured by transportation system effectiveness and efficiency as well as the environmental and climate impacts of the system.

Short-term activity often promotes incremental improvement in fuel efficiency and vehicle emissions controls while long-term goals include migrating transportation from fossil-based energy to other alternatives such as renewable energy and use of other renewable resources. The entire life cycle of transport systems is subject to sustainability measurement and optimization.

Sustainable transport systems make a positive contribution to the environmental, social and economic sustainability of the communities they serve. Transport systems exist to provide social and economic connections, and people quickly take up the opportunities offered by increased mobility with poor households benefiting greatly from low carbon transport options. The advantages of increased mobility need to be weighed against the environmental, social and economic costs that transport systems pose.

Transport systems have significant impacts on the environment, accounting for between 20% and 25% of world energy consumption and carbon dioxide emissions. The majority of the emissions, almost 97%, came from direct burning of fossil fuels. Greenhouse gas emissions from transport are increasing at a faster rate than any other energy using sector. Road transport is also a major contributor to local air pollution and smog.

Transitioning to a sustainable transport system requires innovation in the form of new vehicles, vessels, fuels and service configurations. It is equally important that there is demand for such innovations. The project "Sustainable inland shipping – public procurement as a catalyst" combines the analysis of product and service development on the supply side with the opportunities for public procurement to increase the demand for innovative solutions for local and regional freight transport. Inland shipping can make the transport of goods more ecological.

II. MODERN APPROACH TO SUSTAINABILITY

It can be stated that our future depends not only on the needs of economy and society and impact of our activity on the environment, but also on the use of natural resources of our planet. The economic use of natural resources depends greatly on the built systems and on the applied technology. But if one has a look around Europe or the world he or she can find that considering the above aspects we are far, sometimes very far from sustainability. It can be stated that the economic aspects are well over the two (or five) other. Lower costs, greater profit is the determining factor at the moment. A good sign is that on the governmental level we are aware of this and actions have been taken to change the intolerable situation. So, for sustainable development and transport it is essential to have clear laws, stability in financial support, developed taxation system (pricing), well-defined priorities, etc. but – as we think – it must be based on technology development including the total innovation process from education through research, development, engineering and production to operation (services provided) and recycling. Only the usage of such a philosophy can result that the continuously increasing needs of the economy and society can be covered besides using not more, even less natural resources and generating less impact on the environment.

III. SHARE OF INLAND SHIPPING IN FREIGHT TRANSPORT

There is no general answer to this question because the situation differs from country to country and from river to river. If we concentrate
on the Austrian part of the Danube, only 15% of the available capacity is used. In the Netherlands, inland navigation accounts for 34% of goods transport. An often-mentioned counterargument is the lack of a river connection. This means that shipping is connected to another mode of transport. As a rule, it is the truck that travels the first and last mile. This leads to extra costs.

IV. THE STRENGTHS OF CONNECTING INLAND SHIPPING TO THE TRANSPORTATION NETWORK

Shipping is generally regarded as a very ecological mode of transportation, but its engines do not use the most environmentally friendly fuels, resulting in huge emissions. Calculated in tonnages of transported goods, however, they are lower than in freight transport. The project also considers the type of propulsion of the ships and seeks alternatives to marine diesel, such as liquefied natural gas (LNG), which has lower CO2 emissions. But the ship already has a smaller ecological footprint and is almost unbeatable in terms of transport costs. Approximately 250 trucks would be needed for the amount transported on them. This, of course, also leads to lower personnel costs, as only one captain and a few sailors are needed. In addition, the ship is more efficient and consumes less fuel. If you add to that the external costs that society has to pay – CO2 emissions, noise pollution and particulate matter from braking – then the ship performs much better.

V. ESSENTIAL NEEDS TO ACHIEVE SUSTAINABILITY

There are four essential needs to attain sustainability
• Clear laws
• Stability in financial support
• Developed taxation system
• Well-developed priorities

VI. INDICATORS OF SUSTAINABILITY

Indicators are mainly of three types:
• Economic indicators
• Environmental indicators
• Social indicators

VII. ECONOMIC INDICATORS

TRANSPORT OPERATION COSTS: Transport prices
PRODUCTIVITY / EFFICIENCY: Utilisation rates, Energy consumption efficiency of transport sector, Energy efficiency
COSTS TO ECONOMY: Infrastructure costs, External transport costs, Final energy consumption
BENEFITS TO ECONOMY: Gross value added, Benefits of transport

VIII. ENVIRONMENTAL INDICATORS

RESOURCE USE: Consumption of solid raw materials, Land take
EMISSIONS TO AIR: Transport emissions of greenhouse gases, Greenhouse gas emissions from manufacture and maintenance, Transport emissions of air pollutants, Air pollutant emissions from manufacture and maintenance
EMISSION TO SOIL AND WATER: Polluting transport accidents, Runoff pollution from transport infrastructure, Wastewater from manufacture and maintenance of transport infrastructure, Discharges of oil, Discharges of wastewater and waste
NOISE: Exposure to transport noise
WASTE: Generation of non-recycled waste

IX. SOCIAL INDICATORS

SAFETY AND SECURITY: Accident related fatalities and serious injuries, Security of cargo

THREE TIER CLASSIFICATION OF SUSTAINABILITY INDICATORS

MacRae, proposed a three-tier classification system for sustainability indicators, which we summarize as follows.
1. First-tier indicators focus largely on minimizing the impacts of existing methods, activities or processes (efficiency measures)

2. Second-tier indicators measure the extent to which older methods, technologies, or processes with high negative impacts are being replaced by newer ones with less negative impact (substitution)

3. Third-tier indicators help to measure the extent in which rules and procedures are reconsidered with sustainability as a foundation (redesign)

First-tier performance improvements generally result in early successes (e.g. energy reduction, fuel efficiency). Possible second-tier improvements are conversion from fossil fuel to biodiesel or electricity, whereas a third-tier improvement may be to shift to an innovative transport mode.

### SUCCESSFUL WATERWAY PROJECTS AND FACTORS CONTRIBUTING TO ITS SUCCESSFUL IMPLEMENTATION

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<tr>
<th>Project</th>
<th>Factors</th>
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<tr>
<td>Franprix Paris-Containers on Barge</td>
<td>Close cooperation of stakeholders&lt;br&gt;Short lines of communication&lt;br&gt;Financial support from the region&lt;br&gt;Legislation providing foundation for operational help&lt;br&gt;Location of distribution centre and inland waterway port&lt;br&gt;Dense distribution of shops in city centre High volumes to cover fixed costs</td>
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<td>Vert chez Vous-Floating Distribution Centre</td>
<td>Avoidance of eco tax for heavy vehicles&lt;br&gt;Avoidance urban tolls&lt;br&gt;Compliance to limitations in air priority zones Financial support from inland waterway administration&lt;br&gt;Extended time to enter city centre for deliveries</td>
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<tr>
<td>The Beer Boat Electric Barge Utrecht</td>
<td>Avoidance of two-tons axle restriction Extended time to enter city centre for deliveries&lt;br&gt;Avoidance of congestion&lt;br&gt;Avoidance of one way traffic&lt;br&gt;Public subsidies</td>
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<tr>
<td>Mokum Mariteam-Electric Barge Amsterdam</td>
<td>Extended time to enter city centre for deliveries&lt;br&gt;Applicability of reverse logistics</td>
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### COMPARISON OF NORMAL FREIGHT TRANSPORTATION AND SUSTAINABLE INLAND FREIGHT TRANSPORTATION THROUGH WATERWAYS

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<th>SUSTAINABLE INLAND FREIGHT TRANSPORTATION THROUGH WATERWAYS</th>
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<tr>
<td>More consumption of energy</td>
<td>Least consumption of energy</td>
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<tr>
<td>Require more number of trucks</td>
<td>Single ship could conduct goods that 250 trucks can</td>
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<tr>
<td>Less environment friendly</td>
<td>Environment friendly</td>
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<tr>
<td>More land use</td>
<td>Least land use</td>
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<tr>
<td>Can induce congestion</td>
<td>Can reduce congestion</td>
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<td>Contributes to major share of transportation</td>
<td>Least share of transportation</td>
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X. CONCLUSION

This paper reviews intensively about the great potential of biological method, using the bacteria capable of precipitating concrete can produce cost effective strong or durable structures.

XI. REFERENCES


[5]. “Economical and Ecological Comparison of Transport Modes: Road, Railways, Inland Waterways”, Study prepared on behalf of the Federal German Water and Shipping Administration represented by the Water and Shipping Directorate East