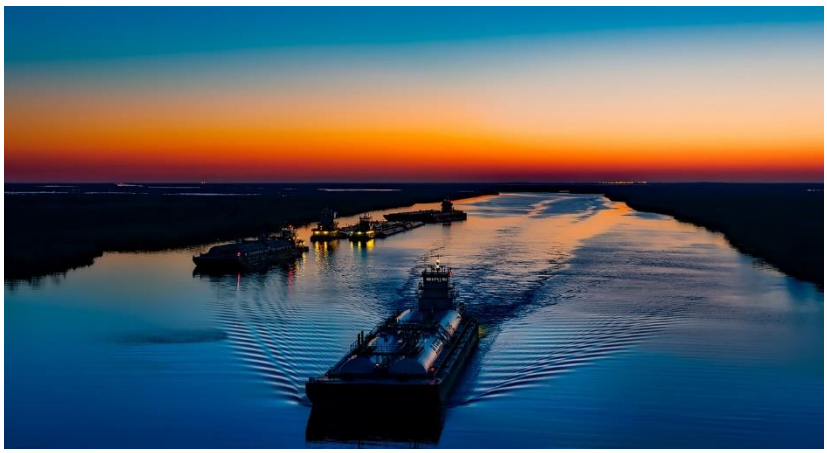
Toomas Lybeck

Prosperous Future of Inland Waterways

“InFuture” Project

(Funded by the European Union, the Russian Federation and the Republic of Finland)



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1. INTRODUCTION

The Maritime Transport Strategy for Finland 2014-2022 says it clearly: Finland will be prosperous, because the Maritime transport will retain its position as an environmentally friendly, energy-efficient and cost-efficient transport mode (Ministry of Transport and Communications, 2014).

Inland Waterways (IWW) should be part of this bright future of Finland. Inland waterway transport (IWT) has proven to be environmentally friendly, energy-efficient and cost-efficient transport mode. Despite its clear benefits “Inland Waterway and River-Sea Shipping (IWT) still do not play the adequate role in the transport system to its potential” … “too often, inland shipping is not even considered as an alternative transport by many forwarders and stakeholders in the transport sector” (EMMA Project, 3.10.2018).

1.1 InFuture project

The “Future potential of Inland Waterways” (“InFuture”, South-East Finland - Russia CBC) project takes a wide-ranging approach for finding solutions for sustainable and cost-effective inland waterway traffic. The project identify the most efficient ways of handling cargo and examines the legislation on freight traffic as well as Finnish and Russian customs policies. In addition, the project takes part in creating an IT system that offers customers a quick and easy way to find the most suitable service for their cargo transport needs (Kotka Maritime Research Centre, INFUTURE – Merikotka).
This review brings together information and best practices that will help IWT stakeholders to focus on possible changes in the near future. The existing waterway systems in Finland, EU and Russia offer a large potential to manage increasing transport flows and decrease congestion of road and railways.

1.2 Climate – the game changer

In 2011 European Commission published the White Paper on Transport (European Commission, 10.3.2019). Its purpose is to show paths towards a competitive and resource-efficient transport system:

“The European Commission adopted a roadmap of 40 concrete initiatives for the next decade to build a competitive transport system that will increase mobility, remove major barriers in key areas and fuel growth and employment. The proposals will dramatically reduce Europe's dependence on imported oil and cut carbon emissions in transport by 60% by 2050. Key goals will include:

- No more conventionally-fueled cars in cities.
- 40% use of sustainable low carbon fuels in aviation; at least 40% cut in shipping emissions.
- A 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport.
- All of which will contribute to a 60% cut in transport emissions by the middle of the century.

1.3 Competitive EU

The White Paper recognizes the strategically important role of IWT for the international business:

“On the coasts, more and efficient entry points into European markets are needed, avoiding unnecessary traffic crossing Europe. Seaports have a major role as logistics centres and require efficient hinterland connections. Their development is vital to handle increased volumes of freight both by short sea shipping within the EU and with the rest of the world. *Inland waterways, where unused potential exists, have to play an increasing role in particular in moving goods to the hinterland and in linking the European seas*” (European Commission, 2011, 2.1./27).

1.4 Multimodal EU

The EU transport policy aims at a form of mobility that is sustainable, energy-efficient and respectful of the environment. These goals can be achieved by using multimodal transport that combines optimally the various modes of transport, exploiting each one’s strength and minimizing the weaknesses.

A Single European Transport Area should ease the movements of citizens and freight, reduce costs and enhance the sustainability of European transport. 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal, appropriate and required infrastructure should also be developed.

By 2050, connect all core network airports to the rail network, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system (European Commission, 2011, 2.5./6).

1.5 IWW´s position in Finland

”Approximately 8 300 kilometers of coastal fairways and 8 000 kilometers of inland waterways are maintained by the Finnish Transport Infrastructure Agency. The total length of waterways maintained by the Agency, 16 300 kilometers, includes nearly 4 000 kilometers of fairways used for merchant shipping. In addition to the Saimaa Canal, which connects the Saimaa Lake District to the sea, the waterway network has 31 other lock canals” (Finnish Transport Agency, Waterways, 3.10.2019).

The Baltic Sea Region with its growing transport volumes, especially between East and West, needs innovative and pragmatic solutions to cope with future transportation requirements. Rivers, canals and also the Baltic Sea have huge capacity reserves, whereas road and rail infrastructure are (at least in some parts of the Baltic Sea Region) overloaded (The Finnish Waterways, 30.1.2019).

There are strategic conditions for future IWT growth, the fulfilment of which is believed to increase the freight flows. One of the key elements will be year-around waterborne transport in Saimaa area and in the Canal. “Another strategic possibility is consolidated shipments serving all shippers in the Saimaa region. The third possibility is to develop Saimaa’s internal transport system, particularly with the transport of future forest-based fuels in mind,” states the development strategy for IWT in Saimaa (Koskinen, 2010, 7-8).

In an interview, Ministerial Adviser Kaisa Kuukasjärvi from the Finnish Ministry of Transport and Communications (MINTC) says that any assessments on possible shift of transport from roads to inland waters and railroad have not yet been made. For the time being, assessments on the impact of increased IWT on the environment and energy-efficiency are missing as well: “Environmental impact assessment, just like all other impact assessments, is being developed all the time to meet better the challenges presented by, for example, the climate targets” (Kuukasjärvi 2019).

The growth potential of the Saimaa Canal and Vuoksi waterway, however, has been assessed: “According to the 2016 service analysis of freight traffic in Saimaa, the estimated growth potential is 1.5 million tonnes. The growth forecast is based on the

assumption that the Saimaa Canal locks are extended, the water level is raised and the navigability season is extended," Kuukasjärvi says. The service analysis anticipates that part of the project shipments currently on wheels could be shifted on inland waters.

2. CURRENT STATE OF IWT

2.1 Road transport

The White Paper to a Single European Transport Area make a prediction: “Freight shipments over short and medium distances (below some 300 km) will to a considerable extent remain on trucks. It is therefore important, besides encouraging alternative transport solutions (rail, waterborne transport), to improve truck efficiency, via the development and the uptake of new engines and cleaner fuels, the use of intelligent transport systems and further measures to enhance market mechanisms” (European Commission, White Paper 2011, 2.1./24.).

Finnish government allowed high capacity transport (HCT) trucks to operate freely on Finnish roads in October 2013: maximum weight 76 tonnes, and maximum height limit 4,4 meters (previous limits 60 tonnes and 4,2 meters). (Liimatainen & Nykänen, 1)

Table 1. Domestic and International road transport

Domestic Road transport			
	Volume of goods	Volume of transport	Vehicle mileage
Year	1000 tonnes	Million tkms	Mn km
2011	312921	23769	2284
2012	293591	21927	1916
2013	269450	20968	1936
2014	273879	20296	1791
2015	267465	21432	1611
2016	274541	24585	1876
2017	277866	26329	1959
TOTAL	**1969713**	**159306**	**13373**

International Road Transport			
	Volume of goods	Volume of transport	Vehicle mileage
Year	1000 tonnes	Million tkms	Mn km
2011	5.232	3.146	171
2012	5.76	3.532	222
2013	5.164	3.461	201
2014	6.219	3.103	184
2015	4.416	3.054	160
2016	4.4	2.266	131
2017	2.845	1.645	92
	34.036	**20.207**	**1161**

(StatFin, 2017)

Examined by types of goods, most gravel and other soil materials were transported by road in 2017, that is, 98 million tonnes, which was good one-third of all tonnes. Most transport performance was generated from transport of saw timber and pulpwood, 3.1 billion tonne-kilometres or 12 per cent of all tonne-kilometres. Measured in kilometres, empty lorries were transported most, 21 per cent of all kilometres (Statistics Finland, 18.3.2019).

2.2 Railroad transport

High in energy efficiency, railroad transport is also quite fast and especially suitable for heavy industry transport needs. It is also a safe transport mode, and the rail network does not suffer from congestion like the roads do. On short journeys, however, railway freight transport is impractical. The number of side tracks is limited, and the maintenance and construction cost of the rail network are considerable (Logistiikan maailma, 18.3.2019).

Table 2. Domestic and International railroad transport

Railroad transport in Finland 2007-2017 (1000 tonnes)			
Year	Domestic	International	TOTAL
2007	26204	14084	**40288**
2008	25484	16453	**41937**
2009	21360	11500	**32860**
2010	23249	12545	**35794**
2011	23505	11322	**34827**
2012	23576	11691	**35267**
2013	22791	13642	**36433**
2014	22742	14266	**37008**
2015	20692	12700	**33392**
2016	21609	14522	**36131**
2017			**38467**

(Finnish Transport Agency, 2017)

The main commodity categories in railroad transport are forestry products, petroleum products, chemicals, machinery, iron, steel, textile and fabrics (Finnish Transport Agency, 2017, 43).

2.3 Inland Waterway Transport (IWT)

Inland waterway transport can be divided into four types of traffic: timber floating, freight transport by cargo vessels and barges, and passenger transport.

“At the moment, only the Saimaa Canal provides opportunity to carry out transport to the sea from the Vuoksi water system area. Kokemäki river and Kymi river are mainly used for passenger transport and leisure boating”, says the ”Sisävesiliikenteen katsaus 2018-2030” review (Kyykkänen et al. 2018, 4).

Table 3. Domestic and international maritime transport through the Saimaa Canal

Year	Maritime transport of goods							
		Domestic			International			Totalt
	Export	Import	Totalt	Export	Import	Totalt	Transit Traffic	
	tons	tons	tons	tons	tons	tons	tons	tons
2007	51092	29008	**80100**	799186	1174771	**1973957**	2703	**2054057**
2008	94428	56328	**150756**	713525	1251457	**1964982**	11760	**2115738**
2009	47271	24117	**71388**	473350	538554	**1011904**	1035	**1083292**
2010	93466	24533	**117999**	586883	955074	**1541957**	-	**1659956**
2011	86266	38501	**124767**	654390	984234	**1638624**	-	**1763391**
2012	23958	14522	**38480**	579668	1100135	**1679803**	-	**1718283**
2013	42990	132	**43122**	571509	1148993	**1720502**	-	**1763624**
2014	56602	20579	**77181**	569820	948051	**1517871**	-	**1595052**
2015	50968	10108	**61076**	596440	659631	**1256071**	-	**1317147**
2016	62524	34014	**96538**	512766	587872	**1100638**	-	**1197176**
2017	74886	25515	**100401**	502992	668639	**1171631**	-	**1272032**

(Finnish Transport Agency, 2017)

Table 4. Goods volumes and transport performance in domestic waterborne traffic

Goods volumes and transport performance in domestic waterborne traffic													
				Months total									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Tons inland waterways	Total	273.607	168.418	143.843	165.079	264.336	470.869	476.217	423.913	1,005,268	826.035	595.786	903.146
	Import	500	0	0	0	0	0	0	0	502.634	414.304	297.893	451.543
	Export	273.107	168.418	143.843	165.079	264.336	470.869	476.217	423.913	502.634	411.731	297.893	451.603

(Finnish Transport Agency, 2017)

Table 5. Saimaa Canal Commodity Groups

	Year 2017	Year 2017
Commodity groups	**Up the Canal/tonnes**	**Down the Canal/tonnes**
Timber	359426	41052
Sawn wood		49338
Wood pulp	7030	55218
Paper		124467
Plywood/Veneers		105
Metals		27956
Coal/Coke	37802	
Fertilizers		129769
Chemicals	12438	
Crude minerals/cement	249567	149973
General cargo	2284	
Other	25607	
ALL	**694154**	**577878**

(Finnish Transport Agency, 2017)

In Saimaa Canal cargo traffic the main commodity groups are timber, paper, sawn wood, pulp, crude materials and cement, metals, coal and coke. (Finnish Transport Agency, 2017, 2)

2.4 Greenhouse gases in Finland

An expert group on transport climate policy under the Ministry of Transport and Communications has drafted a proposal for an action plan for eliminating greenhouse gas emissions in domestic transport by 2045: “The solution for carbon-free transport lies in zero- and low-emission cars as well as in renewable fuels, mileage reduction of passenger cars and sustainable forms of transportation” (Finnish Transport Agency, 2017, 2).

Table 6. Greenhouse gas emissions in Finland/Transport

Greenhouse gas emissions in Finland by Emission category, Greenhouse gas, Information and Year												
		Emission, thousand tonnes of CO2 eq.										
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
1A3 Transport	Total	13.423	12.777	12.205	12.712	12.517	12.209	12.003	10.868	10.858	12.068	11.46
	Carbon dioxide (CO2)	13.302	12.666	12.101	12.608	12.415	12.11	11.905	10.768	10.759	11.968	11.36
	Methane (CH4)	32	28	25	24	22	20	19	19	18	17	16
	Nitrous oxide (N2O)	89	83	80	81	81	79	79	81	81	83	84
	Hydrofluorocarbons (HFCs)	..	..	..	..	..	..	..	..	..	..	..
	Perfluorocarbons (PFCs)	..	..	..	..	..	..	..	..	..	..	..
	Sulfur hexafluoride (SF6)	..	..	..	..	..	..	..	..	..	..	..

(StatFin, 2017)

Table 7. Transport mode comparison

Sector	Share
Maritime	13.6
Railways	0.5
Other Transportation	0.5
Road transport	72
Aviation	13.3
Other Road Transportation	0
Motorcycles	0.9
Heavy duty trucks and buses	18.9
Light duty trucks	8.5
Cars	43.7

(European Environment Agency, 30.11.2018)

2.5 Logistical operating conditions

"Logistics costs in trade and manufacturing were 40.3 billion euros in 2015 of which approximately 27 billion euros were directed to Finland. In relation to the Finnish gross national product, logistics costs of trade and manufacturing were about 12.2% in 2017," states the Finland State of Logistics 2018 by the Turku School of Economics (Solakivi et al. 2018, 14).

In the analysis, businesses were able to assess the operating conditions based on five different elements: "Regional differences are greatest in assessments with regard to transport infrastructure operating conditions. Here, the difference between the best (Helsinki–Uusimaa) and worst (Northern and Eastern Finland) is almost an entire unit." It was also discovered that the level of satisfaction on transport infrastructure has decreased in all areas including, for example, technical condition, capacity and connections. (Solakivi et al. 2018, 89-92).

2.6 Current fleet of ships

The total amount of cargo ships going through the Saimaa Canal was 1029 in 2017. According to the Finnish Transport Agency's statistics, the share of Netherlandic and

Antiqua & Barbudan vessels of the traffic in 2017 was 60%, that of Russian 24% and that of domestic 10%." states the publication. (Finnish Transport Agency, 2018, 21)

For economic reasons, vessels of foreign origin normally abide by the Saimaa Canal's maximum dimensions. "Typically, vessels in internal traffic are of the tug-barge combination type," states the MINTC's "Review on Inland Waterway Traffic 2018–2030" ("Sisävesiliikenteen katsaus 2018–2030"). "Based on the traffic statistics, the average age of foreign vessels travelling in Saimaa is approximately 23 years" … "Finnish vessels travelling in Saimaa are older by comparison, with an average age above 30 years" (Kyykkänen et al. 2018, 21-22).

The ice classification of the vessels has created problems as enough vessels of the IA and IB classes suitable for winter traffic in Saimaa has not been available:

- Vessel of the IA ice class: structure, machine power and other properties are such that the vessel is, if necessary, able to travel in difficult ice conditions assisted by an icebreaker.
- Vessel of the IB ice class: structure, machine power and other properties are such that the vessel is, if necessary, able to travel in medium-difficult ice conditions assisted by an icebreaker.

  (Finnish Transport Agency, 21.12.2018)

3. FUTURE GROWTH OF IWT

3.1 Investments in Saimaa area

The Vuoksi waterway is the part of Finland were inland waterway freight transport is concentrated. The waterway includes Saimaa on the Finnish side and Lake Ladoga on the Russian side. The Saimaa Canal connects the waterway to the Gulf of Finland. For these reasons, the Canal is vital for the development of inland waterway transport.

There are investment plans for extending the Saimaa Canal locks by 11 metres and deepening it by 10 centimetres. The realisation of the investment requires a political decision. The matter will be tackled after the parliamentary elections in April 2019.

“There is not much opposition to the Saimaa Canal development, but whether there is enough support for it in the next Government, that is another matter entirely. The Government will have many other transport projects to consider as well,” points out Tero Sikiö, Head of Inland Waterways Unit, Finnish Transport Infrastructure Agency (Sikiö 2019).

“If the investment is realised, the profitability and competitiveness of IWT will increase. The situation of the industry in the Saimaa region will also, of course, have an effect on the matter. Remembering that the current transport amounts to approximately 1.3 million tonnes and that the record from years back is approximately 2.5 million tonnes, I would suspect that the amount will settle somewhere between these two figures after the investment”

Another factor that affects the competitiveness of the waterway area is the icebreaking situation that will be improved along the adoption of the new self-propelled removable-bow. In the near future, icebreakers are expected to be agile, more powerful and of full breadth (12.6 m). The reformers of the icebreaking equipment are also waiting for the realisation of the Saimaa Canal investment.

3.2 Navigability of the Saimaa Canal

In the current situation, the fairway maintenance cannot guarantee fully year-round navigability season for the Saimaa Canal. The average service break is currently 2.5 months, but this average will be shorter.

“There have been winters during the last 10 years that have facilitated year-round navigation. It is likely that there will be more of these warm winters to come,” says Sikiö. “The locks of the Canal are already technically suitable for winter use. Streams of compressed air move the ice, the so-called “bubbler” lifts warm water to the surface, the walls are heated to prevent ice from sticking in confined spaces and, if necessary, steam containers can be brought in to melt the ice. In addition, our employees are the best in the world when it comes to operating locks in winter” (Sikiö 2019).

The problem is the sections between the locks that require a supply of warm water to prevent them from freezing. It is not efficient to establish a thermal power plant for a need that lasts only a couple of months a year.

3.3 Forest Industry – comments from the stakeholders

Finnish forest industry believes in future growth. There are great expectations with regard to the Saimaa Canal and a longer navigability season. Quotes in this chapter are based on confidential discussions with the IWT stakeholders from January to March 2019:

“UPM transports approximately 0.5 Mcbm of raw wood over Saimaa, divided between ships and floating. The growth estimation for 2019 is approximately 25%.”

“UPM has yearly about 100 ships on Russia’s inland waterways and about 20 in the Baltic region. The amount is estimated to increase approximately 20% in the next few years, depending on the price trend for raw wood in Finland, Russia and the Baltic countries.”

“Stora Enso may increase the use of ships every year in the amount of about 2 ships per month = 20 ships per year if the navigability season is longer. That is an increase of about 10%.”

“If all the forest industry investments in the Saimaa region are realised, there will be too much traffic for the road and railway infrastructure. Furthermore, the EU’s climate targets favour inland waterway transport.”

“The traffic volumes in the Saimaa Canal may easily be tripled by 2030, but it requires political guidance. New types of goods to be transported are being surveyed – goods that are related to the circular economy.”

In addition to the forest industry, steel and mining industry are planning investments that are believed to bring more transport to inland waterways.

3.4 Questionnaire – Future of IWW Transport

On 15 February 2019, a questionnaire regarding the future of inland waterway transport was sent to the stakeholders of the InFuture project. The aim was to the survey personal expectations of IWT transport experts with regard to future development.

All respondents were of the opinion that the development will be slow, i.e. around 0-5%. In an open response, one respondent stated that the inland waterway network is not currently supporting rapid growth: “Rapid growth is possible after 5 years from the start of operation of a Finnish Lakeland-wide infrastructure network (2 outlets to the sea: Kotka and Pori).”

Of the respondents, 33% were of the opinion that the Saimaa Canal will in some time be in round-the-year use (50–70% probability) while 66% thought it unlikely (5–10% probability). 50% of the respondents thought the Saimaa Canal investment plan to extend the Canal locks by 11 metres highly probable (65–80%), whereas 33% of the respondents thought the realisation of the investment improbable. One respondent thought the investment irrelevant in the big picture of the development of inland waterway transport.

Of the global driving forces behind the change, all respondents named the “Environmental sustainability” option as the most important. The second most important was “Customer demand”, the third most important “Rapid technology change” and fourth most important “Growing international trade”. One respondent’s open answer linked the environmental issues with the need to renew the modes of transport and types of inland waterway ships: ”Environmental sustainability will increase IWW transport. But transport models has to be modernized, for example by mega unit and IWW electric vessels that does not sail on open waters”. Another respondent thought the impact of climate change as inevitable: “Socio-economic point of view - Climate warming will be steering cargoes to IWW”.

Of the questions listing the properties of the new types of ships, the option that gained the biggest percentage share was “Cargo capacity”. “Sustainable fuel types and low

consumption” followed right behind it. “Transshipment and cargo handling technology” took the third place, while “Innovative hull construction” became fourth and “Automatization” fifth.

With regard to the Russian market, the respondents expected that the situation would most likely remain uncertain. Two answers put the possibility of growth over uncertainty. An open answer to the question stated that “It would be more important to Finland to examine how to meet the EU Court of Auditors’ claim on the importance of building a transport network.” Even though the uncertainty with regard to Russia was expected to continue, all answers stated that Finnish-Russian cooperation in developing inland waterway transport was important. Of the forms of cooperation, “Opening new business opportunities” was considered by far the most important, with “Solving operative problems” in the second and “Education and research” in the third place. An open answer stated as follows: “Russians need modern ships as described and developed in our EU ULIVES –project.”

As for pilotage, most of the respondents were of the opinion that obligatory pilotage slows down the development of IWT (option “Slowing down the development of transport”). Only slightly over 30% chose the option according to which pilotage makes development possible (“Making the development of transport possible”). What can be deduced from the answers is mainly that the question of pilotage divides opinions. The subject is discussed in more detail in Chapters “Economic efficiency of IWT” and “Digitalization and IWT”.

3.5 “Radical waterborne transport”

Grounds for the development of IWT ships and inland waterways can be found, for example, in the publication of the Committee for the Future 1/2018, “Suomen sata uutta mahdollisuutta 2018–2037” (“100 Opportunities for Finland and the World 2018–2037”). The publication states that “Finland should be especially actively involved in technologies that solve significant societal issues, for such technologies also create global business opportunities and, at the same time, benefits for mankind and society”. (Linturi & Kuusi, 2018)

Environmental technologies and energy efficiency, the importance of which was already established in the aforementioned questionnaire, provide solutions to challenges brought about by the global driving force. Energy efficiency is also considered in the publication

by the committee for the future: “The draught and hull design of ships can be influenced through the latest technology. The draught determines the energy demand when the ship displaces water. The energy demand depends on the weight of the ship and cargo, the model, surface structure and shape of the hull and the speed of the ship. (Linturi & Kuusi, 2018, 264).

The publication also addresses the possibility of inland waterway transport to compete with road transport: “The economic efficiency of inland waterway transport and its development as a substitute to road transport depend on the loading and unloading opportunities, automatic ship mooring to both the piers and locks and special ballast requirements regarding inland waterways and travel in ice. Clearance height is also limited in inland waterway conditions” (Linturi & Kuusi, 2018, 264).

“Ships’ hull materials can be replaced with lighter or even buoyant materials. This helps especially on inland waterways where maximum acceptable draught is shallow. A lighter vessel can carry heavier load or travel on fairways that other vessels cannot efficiently use. New composite materials, such as steel aluminium foam, facilitate very light hull structures.”

Ship structures can also be made lighter by making the vessels unmanned. This will also increase cargo capacity. “Eliminating the crew costs makes is easier to reduce speed which in turn saves energy considerably,” reads a chapter called Radical waterborne transport in the publication by the Committee for the Future. (Linturi & Kuusi, 2018, 264)

3.6 Examples of ship design

Global challenges have been tackled, for example, by the following new ship types:

“NYK SUPER ECO SHIP 2050”

The resistance of the vessel was reduced by 35% by remodelling the hull to decrease water friction, by reducing the weight of the hull, and by minimising air resistance. The improvements where validated with CFD calculations. Further improvements were made by introducing fuel cells for electric propulsion, relying on other highly efficient propulsion devices, and the generation of renewable energy on board the vessel.

The energy demand of the vessel was cut by approx. 70% by eliminating energy and operational waste. The minimized energy demand enables truly emission-free operation. Instead of fossil fuels, the ship is powered by hydrogen produced from renewable energy

sources. Some other futuristic elements in the concept include lightweight bionic design found in nature, the use of 3D printing for building materials, a digital twin of the vessel, and flapping foils inspired by dolphins to replace less efficient traditional propellers.
(Elomatic, 29.11.2018)

“WÄRTSILÄ DUAL-FUEL MEDIUM-SPEED ENGINE”

Wärtsilä has been contracted to supply a complete power system, including two of its 6-cylinder Wärtsilä 20DF dual-fuel medium-speed engines, for a new dry cargo inland waterway vessel. This order extends the benefits of gas fuelled operation to an inland waterway vessel, and represents a strong endorsement of gas as a marine fuel. The vessel will be part of the ECO2 Inland Vessel project. This will be the first ever medium speed, dual-fuel, mechanically driven inland waterway vessel capable of operating for 95-99 percent of the time on LNG fuel, with a minimum of pilot marine gas oil (MGO) used for ignition. The engines are also capable of operating fully on MGO. In addition to the two Wärtsilä dual-fuel engines, the scope of the order includes two fixed pitch propellers in a nozzle, the coldbox, and the LNG tanks.
(Wärtsilä, 8.5.2012)

“LAFFCOMP BIOSHIP 1”

The concept is based on on a self propelled vessel for year-around traffic, the shallow draught of which allows it to use the natural harbours that were earlier used for launching wood in bundle rafts. In addition the vessel transports onboard the pneumatical/cargo crane or conveyer belt system necessary for loading so that no special loading equipment is needed ashore. Novelties of Laffcomp ship design: Vessel monitoring system, lock sysrem, loading and unloading system, LNG fuel system, light weight components.
(Laffcomp, 30.4.2009)

”YARA BIRKELAND AUTONOMOUS SHIP”

The vessel YARA Birkeland will be the world’s first fully electric and autonomous container ship, with zero emissions. KONGSBERG is responsible for development and delivery of all key enabling technologies including the sensors and integration required for remote and autonomous ship operations, in addition to the electric drive, battery and propulsion control systems. A 120 TEU (Twenty-foot Equivalent Units) open top container ship. It will be a fully battery powered solution, prepared for autonomous and unmanned operation. The vessel will reduce NOx and CO2 emissions by reducing diesel-

powered truck transport by around 40,000 journeys per year. This eco-initiative will help to meet the UN sustainability goals, and improve road safety and congestion.
(Kongsberg, 29.9.2017)

”SELF-PROPELLED VESSEL - NEWS”
NEWS is capable of carrying three layers of containers stacked and four side-by-side. NEWS is able to operate on at least 80% of the European Inland Waterways. Logistical and technical features: Re-design of the vessel´s hull (transport efficiency), adaptable draught allows crossing low bridges and reacting to altering water-levels due to a ballast tank (increase days of navigability), adjustable LNG-electric energy – and propulsion system (increase resource efficiency – up to 30% - and decrease of harmful exhaust emission), adapted logistics-system for the respective demands of target markets, possibility of adapting the container vessel NEWS for multi-purpose use such as a river-sea vessel or a car carrier.
(ScienceDirect, 2015)

“WINTECC – INNOVATIVE WIND PROPULSION FOR CARGO VESSELS”
The WINTECC project aimed to demonstrate an innovative wind propulsion technology for cargo vessels. An automatically controlled towing kite system would be used and tested during the regular operation of a cargo vessel for the first time on a full-scale. The innovative wind propulsion technology, that was developed with the WINTECC project, achieved 5% fuel savings – corresponding to 165 tonnes/year of fuel and correspondingly 530 tonnes of CO2 per year for the vessel Beluga Skysails on an average route mix, and10-12% savings on North Atlantic and North Pacific routes. Larger ‘kites’, which will be available soon, will provide higher savings. For fish trawlers also higher yields are expected due to lower ship speed.
(Koutsoutos, 2009)

3.7 Cost benefits of IWT

Maintenance of the Saimaa waterways and Canal has cost approximately 10 million euros a year and that of all waterways 108 million euros in 2017. Thus, waterborne transport constitutes only a fraction of the state’s transport costs compared to the maintenance costs of the roads and railways.

Table 8. Transport maintenance costs in Finland

Maintenance costs (million EUR)								
Road	495.9	540.6	552.7	560.1	568.7	578	604.1	744.3
Railroad	276.9	285	288.9	332.3	331.9	324.1	369.9	419.6
Waterways	74.7	86	79.3	86.2	80.3	68.9	87.4	108

(Autoalan tiedotuskeskus, 31.5.2018)

The cost-benefit analysis, made by M4 Traffic AB and commissioned by Finnish Waterway Association, also show IWT strong sides. This socio-economic analysis covered the social costs (emissions, accident costs, infrastructure maintenance etc.) related to the different transport scenarios that society values and can put a price on. (M4traffic, 2018)

The assignment was to analyze a typical freight transport between Joensuu (Finland) and Dusseldorf (Germany). The calculations based on actual transport volumes of pulp between two cities. The assumptions in the calculations based on studied effects of actual transports by truck, train and ship. All alternatives were calculated one-way direction from Joensuu to Düsseldorf and on a condition of fully loaded vessel, truck or train for a yearly volume of 200 000 mt.
(M4traffic, 2018, 2-4):

Six different transport options and one sub alternative are included in the analysis and compared to each other:

- Alternative 1 Direct vessel – General cargo ship 2 500 dwt and 3 200 dwt
- Alternative 2a Truck (Carelian route) - RoRo ship 9 500 dwt -Truck
- Alternative 2b Truck (Carelian route) - Passanger ferry ship -Truck
- Alternative 3 Truck (Carelian route) - General cargo ship 4 500 dwt -Truck
- Alternative 4 Train (Carelian route) - General cargo ship 4 500 dwt -Train
- Alternative 5 Truck (Savo route) - General cargo ship 4 500 dwt -Truck
- Alternative 6 Train (Savo route) - General cargo ship 4 500 dwt -Train

The results of the socio-economic calculation show that direct vessel transport from Joensuu to Dusseldorf is the most advantageous (Alternative 1). This applies both to the total costs as well as the costs that affects society in terms of wear and tear, accident costs and emissions. “Regarding Alternative 1, the increase in ship size occur after 5 years, and is a result of the proposed investments in The Saimaa Canal”, the analysis points out (M4traffic, 2018, 3).

3.8 Finland, the EU and Russia

There are 40,000 kilometres of navigable inland waterways and 250 inland ports in Europe. Annual transport exceeds 550 million tonnes of which 75% is international transports.

“Finnish inland waters are connected by water to the big lakes of Sweden, Central European inland waterway network and the Black Sea. In future, if the connection between France and Belgium is implemented, it will also be possible to get to the Mediterranean by European inland waters,” says ”Future opportunities for inland waterway transport in Finland 2018–2030” (“Suomen sisävesiliikenteen tulevaisuuden mahdollisuudet 2018–2030”) by WPS Finland Ltd. (Mäntynen et al. 2018, 8).

Many traditional EU transport cargo volumes are expected to decrease due to the environmental norms (e.g. coal and oil). Just like in Finland, biomass transport is taking over a larger share of transport in the EU area. The construction industry and chemicals industry products are also increasing their share. A small increase can also be expected in the agricultural transport sector (Central Commission for the Navigation of the Rhine, 2018, 140-141).

The total length of the inland waterway network on offer in Russia is more than 101,000 km. The network extends over 11 time zones. Russian inland waters provide shortcuts between all the European seas: Baltic Sea–White Sea–Black Sea–Caspian Sea. The potential is, therefore, enormous. This network can be used to transport goods, for example, directly to the centre of Moscow – bypassing the terrible congestion. (Nonius Engineering, 2.7.2018)

National and international inland waterway transport experts agree that linking all modes of transports into a competitive multimodal whole is part of the future. This is the only way Finland gets to be part of the global delivery chains.

3.9 Regions guarding interests

With increasing awareness, Eastern Finland regions have awakened to the need to cooperate in guarding their interests in waterway transport development. One indication of the increased awareness is the Saimaa development office implemented as a project.

The development office is responsible for coordinating the joint development efforts of the Eastern Finland regions, cities and inland waterway stakeholders.

“The transport part of the ELY Centres located in the regions should also be harnessed to promote equally other modes of transports than road transport, as traditionally done by the Finnish Road Administration,” says Jukka Hasu, Project Coordinator at the Regional Council of North Karelia (Hasu 2019).

Inland waterway transport has been in need of guardian of interests, and the increase in common awareness has got people on the move. “The simple truth is that even if we get all the Members of Parliament from Eastern and Northern Finland behind the cause, they would still only represent ¼ of all the MPs. A clear and open national inland waterway strategy would also be a good thing so that the development would not be on the shoulders of a few dedicated experts”, Hasu adds.

4. CONCLUSIONS

The investments in the Saimaa Canal enable navigation by bigger ships and transport of bigger cargos. The cargos will be approximately 3,100–3,200 tonnes – lifting the Canal water level by 10 cm allow the increase of cargo volumes. Better cargo capacity means better profitability. At the same time, the number of ship types that fit the Canal will increase. (Finnish Transport Agency, 24.1.2018)

The combined effect of the Canal, forest, mining and steel industry investments is believed even to double the amount of cargo through the Saimaa Canal. Industrial actors expect the transport volumes to increase to over 3 million tonnes by 2030. The growth makes investments in new vessels topical. The need is believed to be realised within 5 years of the Saimaa Canal enlargement.

According to the "Review on Inland Waterway Traffic 2018–2030" by the MINTC, "with the small yearly growth in goods transport continuing, the growth may bring about approximately one million tonnes worth of additional waterborne transport demand potential by the year 2030" (Kyykkänen et al. 2018, 14). The Ministry working group's growth prospects are more moderate than those of industry. According to the Ministry, higher growth is possible if inland waterway transports also attract part shipments and container transports.

4.1 Concern over the Canal renovation

From the Finnish Transport Infrastructure Agency's perspective, the responsibility for the selection of the mode of transports lies with the shippers.

"They must specify what they want and promise in case the Saimaa Canal investment takes place. If there are cargo consignments, service will be provided. Up to this date, the speed and functionality of the service have been guaranteed," says Tero Sikiö (Sikiö 2019).

One concern has to do with the renovation work of the Saimaa Canal planned to be implemented in two 6-month long periods.

"If the canal lock extension work is started, it will stop the traffic for the two periods. This raises the question of whether the transports will return to the Canal if they are shifted to other modes of transport. The transports will return back if the service and prices are right," Sikiö concludes.

4.2 New “Saimax”

Vessels dimensioned to fit in the Saimaa Canal are called Saimax. The maximum dimensions are as follows: length 82.5 m, beam 12.6 m, height from water surface 24.5 m and draught 4.35 m. The maximum size of the vessels will increase once the Saimaa Canal renovation has been completed.

“Industry has wished that the new Saimax would be 93 metres lengthwise and 12.6 metres breadthwise,” says Tero Sikiö from the Finnish Transport Infrastructure Agency.
“We strongly believe that the cargo volume will be 3,000–3,300 tonnes per vessel. Consignments from and interest among shippers will increase through ecological thinking. The cargo selection will include chemical pulp, paperboard, timber and bulk products,” adds Hannu Kaipainen, Director, Service production at Oy Saimaa Terminals Ab (Kaipainen 2019).

“Though a fossil fuel, LNG will be the prevalent fuel solution in the beginning. Biogas and electricity come into play in the longer term. The technological development of transport over land also steers transport towards greener shipping,” thinks Kaipainen.
In addition to the fuel solutions, loading automation and conveyor solutions for conventional vessels are expected to be other areas for development.

4.3 Timber floating channels, islands and new technology

There are plenty of old 2.4-metre channels in Saimaa that formed the backbone network in the days of the old Canal. Utilising these so-called timber-floating channel routes, especially in raw wood pickup, would increase the transport volumes. That said, their development requires suitable vessels and a sufficient number of consignors.

The LAFFCOMP BIOSHIP 1 mentioned in the “Examples of ship design” chapter is an example of a vessel designed to operate in such a shallow water environment. It is capable of approaching the shore even at shallow points and loading and unloading goods using an onboard crane. Finnish Lakeland islands are an interesting proposition for a vessel that can load raw wood cargo in shallow water.

4.4 Old fleet, new requirements

Finnish inland ships are old (with an average age above 30 years), but in that respect, the situation is not much worse than in other countries. Other European countries also

have fleets consisting of old vessels, and it takes several decades before they are replaced with new ones.

The EU has funded a project (“MoVe IT”) examining the best ways to modernise the old vessels. Though it is not possible to change the hull of a ship without considerable costs, outdated equipment can be replaced. The MoVe IT! project looked for concepts that would be best suited for inland vessel modernisation:

”The ship owners expressed very little interest in power-related retrofits. The reason behind this is that emission abatement techniques such as filters and catalysts can only lead to very limited fuel savings”…”Other solutions like LNG, CNG, Fuel sell, diesel-electric or all electric propulsion all require major modifications to the engine room and large investments”…”The options that are deemed most interesting by the ship owners are those that lead to reduction in fuel consumption, and thereby to a reduction in fuel cost, but do not require a major investment. This implies that the ship owners were primarily interested in optimizing the flow of water around the ship by means of solutions that do not require major adaptations to the shape of the hull itself. Especially replacement of rudders is deemed an interesting option by several ship owners, while two owners are also interested in using a pre-swirlstator in front of the propeller”, says the project report. (Hekkenberg & Thill, 10.9.2014)

When designing new vessels, it should be remembered that the service life of inland vessels has traditionally been exceptionally long. With careful design, modernisation taking place decades from now will be much easier and cheaper to carry out.

The designers should also bear in mind that the intended use of the vessel may change over the decades. If the vessel has been designed flexible also from this point of view, it makes it much easier for the owner of the ship to react quickly on any changes in the business environment.

The SELF-PROPELLED VESSEL – NEWS mentioned in the “Examples of ship design” chapter is designed especially with adaptability and suitability for as many environments as possible in mind. This makes the vessel’s service life management easier.

The number of cargo ships navigating on EU inland waters has decreased, but the volume of transported cargo has not. This has been made possible by bigger vessels.

The design of new vessels has emphasised communication and navigation systems that enable more efficient and safe transports. Vessel investments are significant, but due to the return they offer, the production of inland waterway vessels is predicted to grow by 2024 (Free automotive news, 19.2.2019).

4.5 Economic efficiency of IWT

The Finland State of Logistics 2018 survey by the Turku School of Economics reveals that enterprises in the Finnish Lakeland area are critical of the current state of goods transport. According to the enterprises, transport costs have increased, and the transport infrastructure framework does not anymore fully correspond with the cost development:

“Straight averages show that, regardless of background variables, there is a significant number of enterprises in Finland with considerably high logistics costs related to, for example, transport and inventory holding.” Many of the enterprises believe that logistics and transport costs will increase further by 2021 (Solakivi et al. 2018, 98).

Inland waterway transport can be used to reduce costs to the industry, at least somewhat. Tero Sikiä from the Finnish Transport Infrastructure Agency reminds that while inland waterways are not suitable for all transport, they have been found cost-efficient in, for example, factory-to-factory transport: “There are many ships travelling on the Baltic Sea that will fit the new dimensions of the Saimaa Canal. In future, these could be utilised in round-trip transport” (Sikiö 2019).

Timber floating is an inexpensive way to transport raw wood and, simultaneously, store it. At the moment, only UPM floats raw wood to its production plants. Floated tonnage has decreased from 1.0 million tonnes to 0.25 million tonnes. “If timber-floating stops completely, the price of raw wood transport will go up,” predicts “Review on Inland Waterway Transport 2018–2030” by the MINTC (Kyykkänen et al. 2018, 14).

Costs incurred by IWT also include pilotage that has been subject to considerable public debate. Amendment of the Pilotage Act enables experiments with remote pilotage believed to bring the pilotage costs down in the near future: “Ship pilotage costs will decrease significantly if remote pilotage is taken into wide use. Currently, shipping companies pay approximately 1,400 euros for one pilotage. Approximately one-third of the current pilotage fee consists of costs incurred by transporting the pilot with car and pilot boat” (Aamulehti, 27.2.2018).

4.6 New cargo flows

Containers are a practical way to transport both general cargo and bulk. They play a significant role in European goods transport. Even though the level of inland waterway port infrastructure is generally good, container handling options are limited. This is an important consideration with regard to the development of inland waterway transport because containers, being units that are compatible with other modes of transport, provide at least a framework for a smooth way to move cargo from ship to road or rail. This makes onward transportation around the world possible.

“Conventional handling of full containers and project shipments using own equipment in Saimaa ports is currently not possible. In Joensuu, there is a reach stacker that can be used for handling at the shore. At the moment, conventional handling of containers or project cargos requires a mobile crane to be ordered outside the port,” says Jukka Hasu from the Regional Council of North Karelia (Hasu 2019). “That said, new concepts can be tried out under quite a tight schedule as small ports, and their operators can react quickly to the needs of the customers.”

Jorma Mäntynen, Director at WSP Finland Ltd, suggests that container transport could be developed by introducing international port pairs like, for example, Joensuu and Gdansk: “A ship would have a week’s turnaround time” (Mäntynen et al. 2018, 12). According to Mäntynen, the problem related to the availability of containers should be solved through balanced traffic and a “container depot” model. The model includes container reception, reporting of the location and condition to the owner and carrying out of any repair work needed.

The size of ships in Saimaa limit the capacity of the container vessels compared to those used at sea: “If the current Saimax cargo capacity is approximately 2,500 tonnes, a quick calculation tells us that the vessel can accept 82 containers weighing 30.4 tonnes each. Correspondingly, the 3,200 cargo tonne vessels travelling in the extended Canal can accept 105 containers by calculation. Containers with lighter load could even be loaded with more than this, taking into account any other dimensional limitations the vessel may have,” calculates Elias Altarriba, R&D Specialist at the South-Eastern Finland University of Applied Sciences (Altarriba 2019).

In any case, the figures are diminutive compared to the bigger container ships that can carry 12,000–18,000 containers. Containers can also be used to carry a wide range of

goods, including cold products or liquids in special containers – providing opportunities to diversify the current flow of goods consisting mainly of raw material.

“IWT barges can be loaded and unloaded with a reach stacker, provided the reaching distance is not too long. It must also be made sure that the reach stacker is heavy enough if it is used to lift heavy cargo from few metres away. Reach stackers can be equipped with front support legs that make it possible to lift heavier cargos from greater distances,” recalls Ville Henttu, who has studied intermodal transport at the South-Eastern Finland University of Applied Sciences. “Probably a maximum of 60 TEU containers on one barge so that they can be in three rows and the reaching distance is not too long,” adds Director of Research Henttu (Henttu 2019).

There has been a discussion among the Finnish IWT stakeholders about how to gather small consignments for a cargo vessel. This kind of integration would be important to introduce new product groups and actors to inland waterway transport. According to Mäntynen from WSP Finland Ltd, integration would be a natural part of the port operator’s work: “It could take on a stronger role by taking responsibility for combining the various modes of transport into transport chains as well as smoothing of collection and distribution of decentralised goods flows” (Mäntynen et al. 2018, 23).

“In Finland, most of the bio-based energy is derived from wood as a by-product of forest industry” … “Growth targets have been set in particular for forest chips, that is, wood biomass collected in connection with final felling and thinning of forests,” states the “Review on Inland Waterway Transport 2018–2030” by the MINTC (Kyykkänen et al. 2018, 16). As the global demand grows, the wood biomass must be collected ever further away from the power plants.

According to the MINTC, “Wood energy transport by barge in open water conditions is competitive with road transport on transport journeys in excess of 100 km, provided that the initial terminal transport does not exceed 50 km.” For transports in excess of 100 km, both waterborne and railroad transport are competitive options.

The total transport potential of wood fuel in the Saimaa region is 2.5–3 million tonnes. Connecting the Kymijoki waterway to the wood fuel transport network would require investments in loading and unloading sites, fairways and equipment.

To increase demand, marketing is needed. Since any discussion of Finnish inland waterway transport also includes overseas transports, the marketing also must be international. Finnish enterprises and organisations have often been criticised for poor marketing. This is not necessarily a problem that has nothing to do with wrong attitude, but lack of expertise instead. Finland has just entered the world of digital marketing. It takes time for top expertise to emerge.

Development of inland waterway transport requires an extensive cooperation group, and the services and expertise it provides must be marketed to potential customers. Due to the multitude of actors involved, one solution for the design and implementation of marketing could be an in-house type marketing team tasked to collect up-to-date information from the partners and compile it into marketing packages suited to the target groups. The team would be responsible for establishing the necessary relationships with the domestic and foreign media and mastering digital and other marketing communication channels.

4.7 IWT and Multimodality

“The regions of Eastern Finland are cooperating in preparing the Corridor of Main Road 6, the identification of the nodes along the Corridor being one of the main themes. In prioritising the nodes, the more forms of transport the node includes, the greater the significance it can receive,” explains Jukka Hasu from the Regional Council of North Karelia (Hasu 2019).

According to him, the infrastructure for multimodal transport is in place, but the service offering should be expanded to cover the ports with the most potential.
”Of the city-owned ports, Joensuu’s deep water port and Lappeenranta’s Mustola have the biggest potential. Of the industry ports, Kitee’s Puhos Port and Imatra’s Vuoksi Port have equivalent potential,” thinks Hasu.

Better capacity to handle containers also facilitates seamless combining of various forms of transport and opportunities to tap into international goods flows.

4.8 Digitalization and IWT

In September 2018 European Commission published a working document on digital inland navigation (DINA Study). As a part of it a coalition of IWT operators and ports

proposed its vision towards 2030 that includes same topics that Finnish stakeholders have been planning:

- Traffic planning: Optimisation of lock and bridge schedules in cross-border corridors to reduce waiting times, the overall duration of the voyage and to optimize energy use;
- Route planning: Provision of network information including its operation status to support route planning. Actual and forecast information on the fairway allowing for more efficient planning.
- Voyage planning: Supporting voyage planners with real-time and predicted traffic information and interface to traffic planning services to ensure best possible ETAs.
- Logistic planning: Single window access for the exchange of vessel and cargo position information among logistics users to make waterway transport visible in digital supply chain.
- Single window service limit multiple reporting. In addition, data are collected and analyzed for a more efficient use of the waterway infrastructure.
- Berth management: Berths are the waterway parking space. The tool provides online information about available berths and allows booking.
  (European Commission, 18.9.2018, 12-13)

One of the most important findings of the DINA study was that digitalisation covers more and more areas in society. Therefore, IWT experts should look around and think which of the existing digital solutions would suit to their needs: ”Re-using and building on existing systems could significantly shorten the time to market and avoid duplication of efforts and investments” (European Commission, 18.9.2018, 13).

Tero Sikiö from the Finnish Transport Infrastructure Agency point out that, compared to many other countries, IWT digitalisation and automation is pretty well under way in Finland. That said, there are problems too, like the age of the vessels. Old vessels, for example, do not have bridges with the technology required to utilise the flow of telecommunication. In Finland, digitalisation is being integrated into, for example, channel markings and remote monitoring and management systems. (Sikiö 2019).

Mikki Koskinen from ESL Shipping Oy stated at the “Vesitiepäivät” waterway event in Lappeenranta that “even a simple cargo vessel has 30–40 separate technical systems

in its engine room. All those systems should be made fully automatic, redundant and possibly duplicated." It all costs money, of course. Mikki Koskinen recommends small steps instead of giant leaps in digitalisation: "Add some digital or autonomous features providing clear benefits. That way, the company does not take too big a commercial risk" (Koskinen, 23.1.2019, 8).

Automation providers have started to explore the integration of the systems mentioned by Koskinen. Integration of machinery automation, navigation systems and energy saving methods in a manner allowing the use of information produced by each system on any terminal interests shipping companies, according to a University of Turku Bachelor Thesis (Lehto, 2014, 39).

On 17 January 2019, the Government of Finland decided to amend the Pilotage Act, which entered into force in 2003, to allow remote pilotage subject to authorisation in those public channels in Finnish waters and in the Saimaa Canal lease area that have been marked as routes requiring pilotage. In future, the pilot may perform his or her duties somewhere else than onboard the vessel.

"Performing pilotage somewhere else than onboard the vessel requires new technological solutions also on fairways. The safety devices of the experimental fairway, including buoys, lateral marks and beacons must be equipped with sensors indicating, for example, where the fairway goes and what is the position of the vessel in relation to the safety device. Investments required in the ships for remote pilotage should remain modest," writes Aamulehti in an advance story on the legislative amendment 27 February 2018 (Aamulehti 27.2.2018).

The government proposal draft amending the Pilotage Act states that "Remote pilotage has been tested earlier in, for example, Norway by performing pilotage utilising radar information and VHF radio communications" … "An assessment conducted in Denmark in 2014 (Danish Maritime Authority 2014: Technological Assessment on the Possibility of Shore Based Pilotage in Danish Waters) states that remote pilotage is already technologically possible but, due to the limited experience available, requires careful and progressive testing in order to be implemented in a safe manner" (Hallituksen esitysluonnos, 16.2.2018, 3).

In Finland, pilotage has been digitised by adopting a mobile ERP system for real-time monitoring of the pilotage performance. In the Finnish ePilotage concept, information is collected, produced and processed to facilitate a better service process (Sonninen, 23.1.2019, 3).

4.9 Opportunities in Russia

As stated in the “Future of IWW Transport” questionnaire above, IWT stakeholders consider cooperation with Russia important. Opening new business opportunities and solving operative problems were named as the most important goals for the cooperation.

“Also in shipping to Russia, operational problems have to do with border formalities. In addition, transit traffic to the Caspian Sea ports via canals should be developed,” says Hannu Kaipainen from Oy Saimaa Terminals Ab (Kaipainen 2019).

Likewise, one of the world’s biggest transport projects utilises Russian inland waterways up to the Caspian Sea. Sarens and Tengizchevroil have agreed on a giant project including transport of oil refining modules first by ocean-going ships to the Port of HaminaKotka, and from there, onboard inland water ships to the Tenzig oil field in Kazakhstan:

”The Module Carrying Vessels that are sailing through the Russian Inland Waterway System are purpose built for this project and are approximately 123 m long, 16,7 m beam and a sailing draft of approximately 3 m”, tells Rob Williams, a maritime civil engineering consultant from Waves Group (Williams 2019).

The transport consist of 75 modules. Williams cannot yet say what use has been planned for the 15 module ships after the completion of the giant project in 2021. The vessels used are of the VARD 9 21 type.

”The vessels, of VARD 9 21 design, are designed to carry high deck loads of up to 1800 tons. Each vessel will be equipped with both electric and hydraulic driven winches inclusive frequency converters and HPU’s. The winch package has been designed in close co-operation with VARD Group and once again proves PALFINGER MARINE’s capability to offer tailor-made deck equipment to special purpose vessel designs”. (MaritimeQuote, 3.6.2016)

The ”Future opportunities for inland waterway transport in Finland 2018–2030” paper by WPS Finland Ltd suggest new railroad transport directed from Northern Russia and China to the parallel of Joensuu to be transported via inland waterways further to the Saimaa Canal and Europe (Mäntynen et al. 2018, 10). This idea would provide an excellent connection to the international goods flow, with the Finnish inland waterway network providing a cost-efficient transit platform.

Jukka Hasu, Project Coordinator at the Regional Council of North Karelia, advocates for a clear Finnish strategy as the basis for the development work: “First, we need a common vision and intent with regard to the development in Finland. After that, it is important to carry out cooperation between the EU, Suomi and Russia to determine whether it could be possible to harmonise inland waterway transport to various regions by creating a larger market area instead of separately tailored regional solutions” (Hasu 2019)

5. ”LWT in a pickle”

In the final chapter of this future review, we wish to challenge Aalto University and Admiral Makarov State University to come up with creative solutions for the following container-related questions:

“What methods could be proposed to move containers from ships onto the bed, or vice versa, of a truck standing on the pier in a port that is not yet meant to handle containers?”

“Would it be possible to integrate into a concept ship, at a reasonable cost, compact onboard lifting equipment, or maybe a ramp, to shorten the reaching distance, or some other innovative out-of-the-box-thinking solution?”

“Could wood chip be suitable for container transport where the wood is chipped in the forest straight into containers that are then retrieved on a, for example, light self-propelled barge travelling on 2.4-metre fairways?”

“Ro-ro vessels are loaded by driving the container onboard the ship on a trailer as such. Would it be possible to realise a similar inland vessel loading method including a truck tractor bringing a container-trailer combination to the port where the port’s own ”tractor unit” then loads it onboard the ship? The truck tractor stays behind in the country of origin free to haul new cargos, meaning that it can be owned by, for example, a local entrepreneur. In the country of destination, another truck tractor will then haul the container trailer forward.” (Could the “tractor unit” be onboard the ship in Saimaa, if necessary?)

“Would it be possible to combine the demands for container transport arisen in Finland and Russia so that experts of the two countries could cooperate in designing the next-generation Finnish-Russian container vessel together?”

LIST OF REFERENCES

Altarriba, E. 2019. R&D specialist. Interview by email 6.3.2019. South-Eastern Finland University of Applied Sciences.

Autoalan tiedotuskeskus. Valtion liikennemenojen kehitys. 31.5.2018. Website. Available from Internet: http://www.aut.fi/tilastot/verotus_ja_hintakehitys/valtion_liikennemenot [reference 6.3.2019].

Central Commission for the Navigation of the Rhine. Inland navigation in Europe – Market Observation. Web document. Modified 14.9.2018. Available from Internet: https://www.ccr-zkr.org/files/documents/om/om18_II_en.pdf [reference 20.2.2019].

Elomatic. Elomatic collaborates with NYK Group to create emission-free cargo ship. 29.11.2018. Website. Available from Internet: https://www.elomatic.com/en/elomatic/news/2018/11/29/elomatic-collaborates-with-nyk-group-to-create-emission-free-cargo-ship [reference 4.3.2019].

European Commission. Commission staff working document on digital inland navigation. 18.9.2018. Web document. Available from Internet: https://ec.europa.eu/transport/sites/transport/files/legislation/swd20180427-digital-inland-navigation.pdf [reference 25.2.2019]. 12-13.

European Commission. 2011. White Paper 2011. Mobility and Transport. Website. Available from Internet: https://ec.europa.eu/transport/themes/strategies/2011_white_paper_en [reference 11.1.2019].

European Commission. 2011. White Paper 2011, Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system. Modified: 3.10.2019. Available from Internet: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52011DC0144 [reference 11.1.2019]. 2.1./24., 2.1./27., 2.5./(6).

European Environment Agency. Greenhouse gas emissions from transport. Modified 30.11.2018. Web site. Available from Internet: https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases/transport-emissions-of-greenhouse-gases-11 [reference 2.3.2019].

Finnish Transport Agency. The Finnish Railroad Statistics. 2017. Web document. Modified 6.11.2017. Available from Internet: https://julkaisut.vayla.fi/pdf8/lti_2017-09_rautatietilasto_2016_web.pdf [reference 18.3.2019].

Finnish Transport Agency. Ice Classes of Ships. Website. 21.12.2018. Available from Internet: https://www.traficom.fi/en/transport/maritime/ice-classes-ships [reference 2.3.2019].

Finnish Transport Agency. Saimaan kanavan kehitystoimenpiteet. 24.1.2018. Power Point presentation. Modified 30.1.2018. Available from Internet: https://docs.wixstatic.com/ugd/9247af_684f07aa36284071a1dc54e88a05013c.pdf [reference 25.2.2019].

Finnish Transport Agency. Statistics of the Saima Canal traffic. 2017. Web document. Modified 4.1.2018. Available from Internet: https://vayla.fi/documents/20473/38630/SK_kk_12_2017/26bd9a4c-4da0-4bb2-8e3a-f6c8367f26b2 [reference 18.3.2019].

Finnish Transport Agency. 2018. Traffic through the Saimaa canal and other canals in Finland. Web document. Modified 3.4.2018. Available from Internet: https://vayla.fi/documents/20473/183912/Vuosijulkaisu+2017/4aa6271d-9572-471a-9565-653be0134ee8 [reference 2.3.2019].

Finnish Transport Agency. Waterways. Website. Modified: 3.10.2019. Available from Internet: https://vayla.fi/web/en/waterways#.XIT0juQUlPY [reference 11.1.2019].

Free automotive news. Inland waterways vessels market revenue is to be valued at USD 2,250 billion by 2024. 19.2.2019. Website. Available from Internet: http://freeautomotivenews.com/inland-waterways-vessels-market-revenue-valued-usd-2250-billion-2024/ [reference 25.2.2019].

Hallituksen esitys eduskunnalle laiksi luotsauslain muuttamisesta. Power Point presentation. Modified 26.2.2018. Available from Internet: https://www.lausuntopalvelu.fi/FI/Proposal/DownloadProposalAttachment?...8459 [reference 25.2.2019].

Hasu, J. 2019. Project coordinator. Interview by email 4.3.2019. Regional Council of North Karelia.

Hekkenberg, R.G. & Thill, C. Retrofit solutions for inland ships: The MoVe IT! Approach. 10.9.2014. Website. Available from Internet: https://repository.tudelft.nl/islandora/object/uuid:10dbd2b8-4688-4332-a1b1-aa6b8d5f9c40?collection=research [reference 25.2.2019].

Henttu, V. 2019. Research director. Interview by email 6.3.2019. South-Eastern Finland University of Applied Sciences.

Kaipainen, H. 2019. Service production director. Interview by email 26.2.2019. Oy Saimaa Terminals Ab.

Kongsberg. Final design of ”Yara Birkeland” revealed. 29.8.2017. Press release. Website. Available from Internet: https://www.km.kongsberg.com/ks/web/nokbg0238.nsf/AllWeb/EF62A43FFFC2209FC12581A90047B752?OpenDocument [reference 4.3.2019].

Koskinen, M. 2019. Dry bulk shipowner`s view on digitalization. Seminar in Lappeenranta 23.1.2019. Power Point presentation. Available from Internet: https://docs.wixstatic.com/ugd/9247af_bec668e541a14ba5a70d1e40782e62d7.pdf [reference 25.2.2019]. 6, 8.

Koskinen, P. Saimaan vesiliikenteen kehitysstrategia. 2010. 7-8.

Kotka Maritime Research Centre. INFUTURE – Merikotka. Available from Internet: https://www.merikotka.fi/projects/infuture/?lang=en [reference 11.1.2019].

Koutsoutos, A. WINTECC - Demonstration of an innovative wind propulsion technology for cargo vessels. 2009. Website. Available from Internet: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3074#RM [reference 4.3.2019].

Kuukasjärvi, K. 2019. Negotiating officer. Interview by email 19.2.2019. Ministry of Transport and Communications.

Kyykkänen, S. et al. 2018. Sisävesiliikenteen katsaus 2018-2030. 4, 21-22, 16, 17.

Laffcomp. Bioship 1. 30.4.2009. Web document. Available from Internet: http://www.sisavesi.fi/wp-content/uploads/2018/04/8.5-Keitele-P%C3%A4ij%C3%A4nne-hake-bioship-1-2009-.pdf [reference 4.3.2019].

Lehto, P. 2014. Laiva-automaation suunnittelun ohjeistus. Bachelor´s thesis. Modified 26.2.2014. Available from Internet: https://www.theseus.fi/bitstream/handle/10024/70923/Pasi_Lehto.pdf;jsessionid=F1D1D62DBF257EC5E9F40E837CFED5C3?sequence=1 [reference 25.2.2019].

Liimatainen, H. & Nykänen, L. Transport Research Centre Verne. Impacts of increasing maximum truck weight – Case Finland. Web document. Available from Internet: http://www.tut.fi/verne/aineisto/LiimatainenNyk%C3%A4nen.pdf [reference 15.3.2019].

Linturi, R. & Kuusi, O. Suomen sata uutta mahdollisuutta 2018-2037. 2018. Web document. Modified 16.4.2018. Available from Internet: https://www.eduskunta.fi/FI/tietoaeduskunnasta/julkaisut/Documents/tuvj_1+2018.pdf [reference 2.3.2019].

Logistiikan maailma. Kuljetusten ja jakelun logistiikkaa. Website. Modified 18.3.2019. Available: http://www.logistiikanmaailma.fi/aineistot/logistiikkaa-lukiolaisille/kuljetusten-ja-jakelun-logistiikkaa/ [reference 18.3.2019].

MaritimeQuote. 3.6.2016. PALFINGER MARINE awarded major deck equipment contract for 15 vessels. Internet news site. Available from Internet: https://maritime-quote.com/palfinger-marine-awarded-major-deck-equipment-contract-15-vessels [reference 25.2.2019].

Ministry of Transport and Communications. Maritime Transport Strategy for Finland 2014-2022. Publications 24/2014, 5. Available from Internet: http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/77872/Julkaisuja_24-2014.pdf [reference 11.1.2019].

Ministry of Transport and Communication. Transport emission to zero by 2045. 12.12.2018. Press release. Website. Available from Internet: https://www.lvm.fi/-/transport-emissions-to-zero-by-2045-990384 [reference 1.3.2019].

Mäntynen et al. 2018. Suomen sisävesiliikenteen tulevaisuuden mahdollisuudet 2018-2030. Power Point presentation. 18.9.2018. 8, 12, 23, 10.

M4traffic. Cost Benefit Analysis IWW Saimaa. 30.11.2018. Web document. Available from Internet: https://docs.wixstatic.com/ugd/9247af_0388a1652b8346cc9d626cb0e2ef632d.pdf [reference 6.3.2019].

Nonius Engineering. Russian Inland Waterways: Specifics, challenges, solutions. Power Point presentation. Modified 2.7.2018. Available from Internet: https://www.unece.org/fileadmin/DAM/trans/doc/2018/sc3wp3/5.8_NONIUS_Engineering.pdf [reference 10.3.2019].

Project EMMA. Background to EMMA. Website. Available from Internet: http://www.project-emma.eu/content/background-emma [reference 11.1.2019].

ScienceDirect. A Green and Economic Future of Inland Waterway Shipping. 2015, 317-322. Web document. Available from Internet: https://reader.elsevier.com/reader/sd/pii/S2212827115004850?token=2C4F811B19B23DEA96A1AADEAF2D1D8F0D2AAE7F9FB6C536892755B2559CA1DBE8968FE374A0F1E69422AE334BFF8A0C [reference 4.3.2019].

Sikiö, T. 2019. Head of department. Interview by email 20.2.2019. Finnish Transport Agency.

Solakivi, T. et al. Logistiikkaselvitys 2018. Turun Kauppakorkeakoulu E-2:2018. Web document. Modified 9.1.2019. Available from Internet: https://student.xamk.fi/opiskelu-ja-tukipalvelut/Documents/XAMK_la%cc%88hdemerkinta%cc%88ohje%202017%20versio%209.3.2017.pdf#search=l%C3%A4hdeluettelo [reference 1.3.2019].

Sonninen, S. 2019. Digitalisaation mahdollisuudet Saimaalla. Seminar in Lappeenranta 23.1.2019. Power Point presentation. Available from Internet: https://docs.wixstatic.com/ugd/9247af_946784061cf145a6b3ec0cc177bc6ee4.pdf [reference 25.2.2019]. 3.

Statistics Finland. Goods transport by road 2017. Website. Modified 18.3.2019. Available from Internet: https://www.stat.fi/til/kttav/2017/kttav_2017_2018-04-26_tie_001_en.html [reference 18.3.2019].
Statistics Finland. Greenhouse gas emissions in Finland, 1990-2017. Website. Available from Internet: http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__ymp__khki/statfin_khki_pxt_111k.px/?rxid=5df94d96-9661-4f08-8d98-5aa738d8761b [reference 18.3.2019].

The Finnish Waterways. Choose Waterways – the most advantageous way regarding the socio-economic impact. 30.1.2019. Web site. Available from Internet: https://www.vesitiet.org/single-post/2019/01/30/Choose-Waterways---the-most-advantageous-way-regarding-the-socio-economic-impact [reference 1.2.2019].

Turkki, K. 2018. Laivojen luotsausta etänä kokeillaan pian – väylä ja satama vielä salaisuuksia. Aamulehti 27.2.2018.

Williams, R. Maritime consultant. Interview by email 22.2.2019. Waves Group.

Wärtsilä. Wärtsilä to power future inland waterway vessel. 8.5.2012. Website. Available from Internet: https://www.wartsila.com/media/news/08-05-2012-wartsila-to-power-future-inland-waterway-vessel [reference 4.3.2019].