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Potential analysis of innovative solutions for inland navigation on waterways in the Berlin-Brandenburg region

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The ongoing digitization is changing the transportation and logistics sector fundamentally. It enables new, sometimes industry-external competitors with an intelligent, disruptive business model to challenge established players and gain market shares. The competitive landscape will become more heterogeneous and market entry barriers will decline. Thus, digitization increases the pressure on the established players to enhance their innovative strength and check their processes for the "digital fit". This applies in particular to inland waterway transport, which does not necessarily appear as innovation-friendly. In order to ensure the (intermodal) competitiveness of waterway transport in the medium to long term, a much more intensive orientation of inland waterway transport towards digital trends is indispensable in the future. Since Germany's Federal Transport Infrastructure Plan 2030 foresees hardly any significant investment measures in the Berlin-Brandenburg region, the competitiveness of the waterway transport can only be maintained and extended, if it is possible to make operation with smaller vessels more efficient through innovations.

The consideration of the cost structures for the waterway transport provides a rather ambivalent result. The use of self-propelled units can, in principle, help to reduce the costs of transport on the waterways. This applies in particular with regard to staff and operating costs. In return, additional costs arise in the case of new buildings in particular. Furthermore, the results show that a cost comparison has only a model character and depends on many influencing factors. A reliable cost estimate can therefore only be made if specific transport cases are known. Despite these considerations, it seems necessary to continue the path of fleet modernization. The existing fleet is outdated and supposed to phase out in the coming years. Fleet modernization holds potential, to consider more efficient and environmentally friendly technologies. In addition to battery electric drives, LNG or hydrogen propulsion is conceivable.

Independent of the size of the ship, the ships in service today, even retrofitted, are hardly suitable for autonomous operation. Elements such as the cab, crew quarters, heating systems, but also electronic equipment such as radar system and electronic maps are in principle no longer needed in the case of unmanned operation. This place can instead be used for transport purposes or the ship units can be built easily. In addition, new designs and materials are possible that reduce the cost of maintenance and are adapted to new transport requirements. In addition, autonomous ship operations require the integration of additional technology, both ship and shore, as all the tasks the ship's master takes today must be transferred to the ship's system. This includes the installation of additional components like permitting permanent monitoring of operating conditions or new drives to make the ship particularly manoeuvrable. The basic technology needed to operate autonomous ships already exists for the most part.

On the landside, an autonomous ship operation requires a high-performance ICT infrastructure along the waterways for a stable data exchange and an IT infrastructure / cloud as well as a complete coverage with AIS land stations. Other infrastructural requirements include e. g. virtual navigation signs, land-based CCTV cameras and sensor equipment of relevant infrastructures such as bridges, locks and jetties. When using a battery electric concept, a charging infrastructure is also required. As the responsibility for the operation of the autonomous units is transferred from the skipper to the land organization, a control center shall be set up to ensure the planning, supervision and safety of the operation of the vessel. This results in additional requirements for the qualification of the staff, which includes not only dispatching experience but also nautical and IT skills. In order to enable this development and testing of an economically operable, autonomous ship, the initiators of a specific pilot project, within which a prototype is designed, tested in a designated test area as a "showcase" and then further developed to market readiness, are required. In addition to shippers and shipping companies, the identified relevant players from the fields of technology, science, shipbuilding and administration from the Berlin-Brandenburg region should be actively involved and accompanied in a moderated process.

By defining a concrete application case and its requirements, the framework to develop an autonomous ship unit, build a prototype and test it on a designated test track can be set. Under the support of various technology and development partners, it can be continuously developed to market readiness. The establishment of a test field can be carried out on request at the Directorate General for Waterways and Shipping in Bonn, which is in general positive about the further digitization of the waterway, so that support for the pilot project seems to be realistic. A link to the Watertruck project in Belgium, which is intensively involved with modular ship units in Belgium, is also recommended, as is the option of using a joint test field with the Elektra project. For the involvement of a specific shipper, either a classic bulk haulier is considered, which already uses the barge today or a "modern" shipper for the implementation of new logistics concepts on the waterway. From the experts point of view, a decisive factor in the success of a project is to define a clear driver and defined responsibilities. In addition to the responsibilities, a high commitment of all partners is the most important factor for a successful implementation, which could be achieved by a financial involvement of the partners. At the same time, it should be clarified which funding can be acquired for the project in order to guarantee start-up financing. Autonomous ship operation in the test field can be carried out without a change in legislation, as long as a skipper is on board the prototype under test, thus complying with the currently applicable inland navigation regulations. However, in the long term, a secure legal framework needs to be created to clarify liability issues and, as a result, allow insurance companies to insure autonomous vessels. In addition, risks such as cyber attacks, software errors and power failures must be considered and regulated. In order to achieve a high level of public acceptance, an accompanying political communication is recommended.

The development of innovative solutions for inland navigation in the Berlin-Brandenburg region is closely connected to further projects regarding the digitisation of inland waterway

transport in Germany. In 2016 HTC presented a set of measures to digitise inland waterway transport on the Elbe river (http://www.hamburg.de/bwvi/elbe-4-0/). Besides autonomous sailing on the Elbe river further measures such as the implementation of a digital lock (order) management and a simplification of administrative procedures for the payment of infrastructure charges as well as port and waterway registrations by digital solutions were raised.