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EDITORIAL

Information Systems in Intermodal Transportation and Traffic Management

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Digitalization is one of the great scientific, technical, economic, ecological and social challenges of the 21st century. Despite the current relevance of this topic, digitalization already has a remarkable history – from the digitization of books, texts, images and video recordings, over the automation of individual production steps resulting in completely integrated and digitized factories, to the development of apps that digitize everyday tasks. This development has also always been the catalyst for disruptive technologies that restructure entire markets.

Information systems are the basis for successful and ever-increasing digitalization. One of the most important findings with regard to the development and operation of information systems is certainly the move away from stand-alone solutions towards fully integrated ones that integrate suppliers, producers and customers. Such fully integrated information systems enable the operation of complex supply chains whose successful operation depends, among other things, on the availability of relevant information. In addition to the suppliers and producers involved, the subsequent customers also benefit from the broad availability of this information. They can be notified of the expected production and delivery times. Here, increasingly shorter delivery times are the unique selling point for suppliers to win customers in a highly competitive market. Especially the information about the delivery time for intermodal deliveries is subject to strong qualitative variations, depending on the integration degree of the information systems and the information available. Balster et al. address this challenge by investigating how Machine Learning methods can be used to predict the estimated time of arrival for intermodal deliveries. For each transport step in the considered intermodal transport chain the authors used different approaches from the field of machine learning and combine them with each other. They combine linear regression trees, random forest and gradient boosting and ordinal forests. The high complexity of this approach becomes clear when looking at the data used for this purpose. In addition to information on logistics, weather and customer information is also used to predict ETA. The idea here is to inform all key decision makers along the intermodal supply chain about potential delays as early as possible, so that potential problems can be addressed timely and the resulting delay can be minimized.

Beyond that, the ongoing digitalization also changes people's mobility behavior, which manifests itself for example in the ride-share concepts in large cities. It has never been easier to compare and combine different modes of transport for the journey from one's own front door to a destination via app. Especially in big cities this makes owning a car almost obsolete, which in the long run will have a positive effect on the environment and quality of life in metropolitan areas. However, the solutions created so far also require constant revision in order to further improve the benefits of digitalization. Schulz et al., for example, show in their article that different stakeholders and their interests can have a negative impact on the quality of the mobility service platforms that have emerged

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and propose possible adjustments that make corresponding information systems in the mobility sector more integrative and thus make intermodal travel options more attractive. The authors illustrate the contrasting reasons for this fact by means of a good example: State actors have a strong interest in being able to offer local public transport as affordably and spatially extended as possible. In particular, more rural regions should be included. At the same time, the possibilities for changing the transport medium ought to be taken into account when structuring the timetables. The requirements of the infrastructure for the distribution of tickets will also differ in this example. Younger people are more likely to book their tickets via smartphones, whereas older people should be given the opportunity to buy tickets without using a smartphone. This constellation makes the implementation of a high-quality and functional information system rather difficult. The result is the already existing isolated solutions of systems and apps that are needed for the use of local transport and the more recent mobility concepts.

The maritime domain will also benefit enormously from holistic digitalization. Due to the strong interconnection and dependencies among the respective actors in the maritime domain, information systems for digitalization can have a far-reaching positive effect. Apart from efficiency reasons and the associated cost optimization, the use of modern information systems has the potential to contribute to traffic safety and environmental protection at sea. An interesting starting point here certainly are traffic control centers and the development of information systems and intelligent algorithms that can support humans in maritime surveillance. Automated and assisted maritime surveillance has the great potential to detect potentially dangerous behavior of ships at an early stage. The crew in traffic control centers can be automatically alerted to such ships and appropriate action can be taken. Furthermore, such systems and algorithms can also be used for monitoring and speed control of ships, for example to keep emissions in the sea area as low as possible.

This is made possible by research work in the area of Big Data. The existing work in this field analyzes historical ship movement data with the aim of extracting typical movement patterns. These motion patterns can then be compared with current ship movement data to detect anomalous behavior. In this issue, for example, the approach of Filipak et al. is presented. In this paper the authors propose an approach to automatically extract typical traffic patterns from historical ship movement data. For this purpose, the authors choose the combination of an approach to identify maneuver points and a genetic algorithm. The result is a topological traffic network that represents typical ship movement within the investigated sea area. Integrated into a sea area surveillance information system, such an approach has the potential to implement the anomaly detection in vessel traffic as described above and thus to support humans in sea area surveillance. Furthermore, such an approach can be integrated into an information system for route planning. This can then assist the navigator in planning a safe route, which in turn can help to avoid planning unsafe routes and thus protect life, equipment and the marine environment.

All in all, this issue demonstrates that research on information systems takes place in many different fields and in many different domains. We believe that the articles highlight the scientific efforts in each area and illustrate how information systems can contribute to successful digitalization.

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