Volume 2
Towards Innovative Freight and Logistics
Edited by Corinne Blanquart, Uwe Clausen and Bernard Jacob
Towards Innovative Freight and Logistics
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Acknowledgments

The European Commission, DG MOVE and RTD, the Conference of European Road Directors (CEDR), the European Road Transport Research Advisory Council (ERTRAC), the European Rail Research Advisory Council (ERRAC) and the European technology platform WATERBORNE-TP are acknowledged for their support and active contribution to the Programme Committee of the TRA2014, in charge of reviewing and selecting the papers presented at the conference, which form the main input of this volume.

The French Institute of Science and Technology for Transport, Development and Networks (IFSTTAR) is acknowledged for having successfully organized the TRA2014, in which 600 high quality papers were presented.

Isabelle Dussutour, Pierre Marchal and Mark Robinson, coordinators of the topic on Freight and Logistics, all the other members of the Programme Committee, the reviewers who actively contributed to review and select the papers, and the authors who wrote them, are acknowledged for their great work which produced the material for this volume.

Joëlle Labarrère, secretary of the Programme Committee of TRA2014, is acknowledged for her valuable help to the editors and for her support to the production of this volume.
The transport sector is very much concerned about environmental adaptation and mitigation issues. Most of these are related to the objective of curbing GHG emission by 20% by 2020, alternative energy and energy savings, sustainable mobility and infrastructures, safety and security, etc. These objectives require the implementation of advanced research works, to develop new policies, and to adjust education and industrial innovations.

The theme and slogan of the Transport Research Arena held in Paris (TRA2014) were respectively: “Transport Solutions: From Research to Deployment” and “Innovate Mobility, Mobilise Innovation”. Top researchers and engineers, as well as private and public policy and decision-makers, were mobilized to identify and take the relevant steps to implement innovative solutions in transport. All surface modes were included, including walking and cycling, as well as cross modal aspects.

Policies, technologies and behaviors must be continually adapted to new constraints, such as climate change, the diminishing supply of fossil fuels, the economic crisis, the increased demand for mobility, safety and security, i.e. all the societal issues of the 21st Century. Transport infrastructures and materials, modal share, co-modality, urban planning, public transportation and mobility, safety and security, freight, logistics, ITS, energy and environment issues are the subject of extensive studies, research works and industrial innovations that are reported in this series of books.

This book is part of a set of six volumes called the Research for Innovative Transports set. This collection presents an update of the latest academic and applied research, case studies, best practices and user perspectives on transport carried out in Europe and worldwide. The presentations made during TRA2014 reflect on them. The TRAs are supported by the European Commission (DG-MOVE and DG-RTD), the Conference of European Road Directors (CEDR), and the modal European
platforms, ERRAC (rail), ERTRAC (road), WATERBORNE, and ALICE (freight), and also by the European Construction Technology Platform (ECTP) and the European Transport Research Alliance (ETRA).

The volumes are made up of a selection of the best papers presented at TRA2014. All papers were peer reviewed before being accepted at the conference, and were then selected by the editors for the purpose of the present collection. Each volume contains complementary academic and applied inputs provided by highly qualified researchers, experts and professionals from all around the world.

Each volume of the series covers a strategic theme of TRA2014.

Volume 1, *Energy and Environment*, presents recent research works around the triptych “transports, energy and environment” that demonstrate that vehicle technologies and fuels can still improve, but it is necessary to prepare their implementation (electro-mobility), think about new services and involve enterprises. Mitigation strategies and policies are examined under different prospective scenarios, to develop and promote alternative fuels and technologies, multi-modality and services, and optimized transport chains whilst preserving climate and the environment. Evaluation and certification methodologies are key elements for assessing air pollution, noise and vibration from road, rail and maritime transports and their impacts on the environment. Different depollution technologies and mitigation strategies are also presented.

Volume 2, *Towards Innovative Freight and Logistics*, analyzes how to optimize freight movements and logistics, introduces new vehicle concepts, points out the governance and organization issues, and proposes an assessment framework.

Volumes 3 and 4 are complementary books covering the topic of traffic management and safety.

Volume 3, *Traffic Management*, starts with a survey of data collection processes and policies and then shows how traffic modeling and simulation may resolve major problems. Traffic management, monitoring and routing tools and experience are reported and the role of traffic information is highlighted. Impact assessments are presented.

Volume 4, *Traffic Safety*, describes the main road safety policies, accident analysis and modeling. Special focus is placed on the safety of vulnerable road users. The roles of infrastructure and ITS on safety are analyzed. Finally railway safety is focused upon.
Volume 5, *Materials and Infrastructures*, is split into two sub-volumes, investigating geotechnical issues, and pavement materials’ characterization, innovative materials, technologies and processes, and introducing new techniques and approaches for auscultation and monitoring. Solutions to increase the durability of infrastructures and to improve maintenance and repair are shown, for recycling as well as for ensuring the sustainability of the infrastructures. Specific railways and inland navigation issues are addressed. A focus is put on climate resilient roads.

Volume 6, *Urban Mobility and Public Transport*, highlights possible innovations in order to improve transports and the quality of life in urban areas. Buses and two-wheelers could be a viable alternative in cities if they are safe and reliable. New methodologies are needed to assess urban mobility through new survey protocols, a better knowledge of user behavior or taking into account the value of travel for public transport. The interactions between urban transport and land planning are a key issue. However, these interactions have to be better assessed in order to propose scenarios for new policies.

Bernard Jacob, Chair of the TRA2014 Programme Committee

Jean-Bernard Kovarik, Chair of the TRA2014 Management Committee

March 2016
Introduction

Freight transport faces a dual challenge. It must satisfy the demands of globalized trade on the one hand and meet environmental requirements on the other. In this context, innovation is a crucial topic to enable the transition of the current transportation and logistics system into a sustainable one. This volume provides an overview of the latest technological innovations all over Europe with additionally some international examples, based on ICT (Information and Communication Technologies) or new vehicle concepts, for all modes and all scales (urban, regional, national or International).

Innovation is a key factor of economic and social evolution. In the European Union, innovations are on the political agenda to transform the current transport system into a sustainable transport system. Transport has the potential to become one of the most innovative industrial sectors in Europe. Research and development in freight transport have a high priority in both Europe and North America, because of its importance for the economy, employment, and European integration. The competitiveness of enterprises and countries, and business as a whole greatly depend on freight transport efficiency. In addition, innovations help in coping with the challenges of reducing greenhouse gas emissions and fossil energy consumption.

Research and innovation support any sustainable transport policy, are necessary to meet the objectives of the European white paper of 2011, and allow the emergence and deployment of technical solutions for the transition of the current transportation system into a sustainable transportation system. Nevertheless, innovation in the field of transport creates a great paradox: nearly a quarter of European private research is dedicated to the transport sector; ten of the twenty companies with the largest research budgets in Europe belong to this sector with a performance among the most innovative in Europe – and yet transport is not, as with

Introduction written by Corinne BLANQUART, Uwe CLAUSEN and Bernard JACOB.
nano-technology, micro-electronics and biotechnology, associated with an image of advanced technologies, innovation and high creativity. One of the reasons for this is that transport is only understood as an integrator of external technologies, whether specific or generic.

This volume highlights how innovative the transport sector is. Telematics, safe logistics systems and new vehicle and transport concepts, including electric mobility, are among the topics investigated and the research works presented during the Transport Research Arena (TRA) 2014, and described in this volume. It shows the specificity of innovation in the field of transport, as the ability of a concept, a composition, or the “Engineering” to control a complex system.

However, despite the achievements in the implementation of innovation policies, environmental issues remain a consequence of transportation activities. This requires more radical innovations and technological leaps. This volume shows the way to promote the diffusion of radical innovation in the goods transportation system. One conclusion is that radical innovations spread through changes in the organization of the system.

That is why technological and infrastructural innovations are necessary, but not sufficient for achieving efficient logistics and transport chains. Non-technological innovation, i.e. innovative supply chains, processes and business models are also addressed in this volume. The deployment of innovative solutions requires a change in the transport system organization and in the relationships between industrial and governmental players, regulators, operators, users and customers. These aspects are also analyzed here.

The target audience of this volume is researchers, as well as practitioners, industrialists and decision-makers. For researchers, the volume gives an up-to-date picture of the latest innovations in the field of transport. For practitioners and industrialists, the volume highlights the importance of considering innovations as part of a social system, taking account of the possibilities of adoption by the social system of transport. For decision-makers, it provides recommendations to promote innovation and its diffusion.

This volume first presents the potential of technological innovations in freight traffic management, information systems and vehicles, then moves on to address stakeholders’ governance issues and innovation assessment.
I.1. Optimization of freight and logistics

Mastery of information, allowed by the latest management systems, is the basis of the development of co-modality, i.e. using each transport mode as efficiently and economically as possible throughout the whole transport system. Logistics supply chains cross from mode to mode. Advanced information and communication technologies contribute towards co-modality by improving infrastructure, traffic and fleet management and facilitating a better tracking and tracing of goods across the global transport networks.

Achieving such mastery is the aim of intelligent freight, as it involves ICTs in infrastructures and vehicles. For logistics and transportation companies, a proper integration of ICTs is the key to innovate and supply a whole new range of services. However, ICT adoption remains uneven: smaller businesses tend to focus mainly on transportation operations and only occasionally integrate information management, while larger operators tend to “neglect” physical transportation in order to focus more on coordination, organization and service management; as such, they are more likely to adopt the tools and methods of intelligent freight.

The European white paper describes freight in a “hub and spoke model” which distinguishes between the last mile and city logistics and long haul freight (above 300 km), with the short haul between both. Among the targets, cities should only use clean vehicles (no or very low emissions and non-fossil energy), and a 50% modal shift to rail/sea/waterborne transport is required for freight above 300 km. These ambitious targets require more dedicated research exploiting the potential for disruptive innovations. Improving quality and reliability of rail/sea/waterborne networks and optimized information flow for smooth transition between modes will be crucial. ITS solutions dedicated to urban freight are potentially very numerous, but so far have not been used in many cities. Among the most eagerly anticipated solutions are: real-time traffic information focused on truck drivers, online reservation of loading/unloading areas, and systems for consolidating urban deliveries.

This raises a variety of challenges to support mobility for growth, notably enhancing safety and reducing transport’s dependency on fossil fuels, whilst promoting co-modal logistics services that deliver attractive solutions improving the efficiency and resilience of supply chains, and allowing more sustainable choices to shippers, operators and pro-active receivers of goods.

This part defines concepts such as smart corridors connecting smart hubs, and the implementation conditions of management systems for long distance road transport as well as for rail transport. It also highlights specificities for the use of ITS in urban freight, with route and delivery area booking issues.
I.2. New vehicle concepts

New concepts of vehicles could provide innovative solutions in order to optimize energy consumption and efficiency. Avoiding unnecessary trips may also reduce energy consumption.

The potential benefit of using higher capacity vehicles is investigated in several Northern European countries, as well as in other regions of the world, with major productivity gains expected. Higher capacity vehicles may improve fuel efficiency and reduce emissions by reducing the vehicle-kilometers travelled for the same mass or volume (payload) mileage. Introducing these higher capacity vehicles would require some regulation adaptations.

Besides vehicles themselves, other options are proposed concerning their operation. Platooning, i.e. forming trains of heavy vehicles at short or very short distances, may reduce the aerodynamic effects and drag forces and therefore increase fuel efficiency up to 5 to 7%, as well as lane capacity. Eco-driving strategies comprising fuel consumption and safety are quite efficient to reduce energy consumption up to 10%. In a limited budgetary context, solutions which do not require changing the existing infrastructure or building new infrastructure are of high interest. Another challenge consists of optimizing maintenance.

Innovation not only concerns road transport, but modal shift is also dependent on innovations of non-road vehicles. Inland navigation is an efficient, safe and environmentally-friendly mode of transport. Performing technologies usually result in higher logistics efficiency and lower operating costs. These can be achieved by targeted fleet innovations, e.g. vessel design, further automation, including ICT, which are described here.

The interdependency between vehicles’ innovations, improved logistics solutions, transhipment, training and governance is highlighted.

I.3. Governance and organizational issues

The freight transport system is considered as a socio-technical system, referring to the interactions between stakeholders, technologies and infrastructure. Socio-technical systems consist of a cluster of elements, including technology, regulation, user practices and markets, cultural meaning, infrastructure, maintenance networks and supply networks.

In this framework, smart and integrated freight transport results from the joint optimization of the social and technical factors. Thus, optimization of each aspect