DOI: [10.9774/GLEAF.2350.2015.ju.00003]

Guest Editorial

Sustainable Mobility in China and its Implications for Emerging Economies

Volume 2 Issue 1 *June 2015*

Fuquan Zhao
Tsinghua University, China

Han Hao
Tsinghua University, China

Michael Zhang
Nottingham Trent University, UK

DRIVEN BY RAPID ECONOMIC GROWTH and urbanisation, China's transport sector underwent profound changes over recent years, with mass motorisation as one of its major characteristics. China's vehicle stock grew from 16 million in 2000 to 154 million in 2014, implying an annual growth rate of 17.5%, which is comparable to the highest growth rates of developed countries during the same historical period (National Bureau of Statistics, 2014). The rapid growth of vehicle ownership raises concerns over several issues, including urban traffic congestion, energy security, air pollution and climate change. In Beijing, vehicles were responsible for 31.1% of PM2.5 emissions from local sources, topping any other single source (Beijing Municipal Environmental Protection Bureau, 2014). China's transport-associated CO_2 emissions accounted for about 8% of total CO_2 emissions from fuel combustion in 2011, and is increasing faster than any other sectors (IEA, 2013). Recent research suggests that energy consumption and greenhouse gases (GHG) emissions from China's transport sector are likely to keep increasing through 2030 (Development Research Center of the State Council, 2009). How to establish a sustainable mobility system is one of the greatest challenges China faces.

From a scientific research perspective, there is an urgent need to understand the underlying reasons and dynamics behind changes in China's transport sector, identifying key challenges and opportunities in addressing the emerging issues, and developing strategies and roadmaps to achieve the target of sustainable mobility (Zhang and Yazdani, 2014). In this special issue of the *Journal of Sustainable Mobility*, we have included four original research articles, which address the above-mentioned issues

from the perspectives of urban transport structure, suburban transport, advanced vehicle market diffusion, and eco-efficiency assessment of automotive products, respectively. As the current transportation issues in China share significant similarity with other large developing countries, we hope the insights into China's sustainable mobility will shed some light on the common issues other developing countries encounter.

The tremendous growth of vehicle stock has caused substantial changes in the transport system and structure. For instance, the share of vehicle travel out of total urban travel in Beijing increased from 23.2% in 2000 to 34.2% in 2014. During the same period, the share of non-motorized travel decreased from 41.5% to lower than 20% (Beijing Transportation Research Center, 2013). Infrastructure plays an essential role in determining transport structure. Since 2005, China has invested over 1 trillion yuan (US$161.3 billion at the 2013 exchange rate, World Bank) in the construction of urban rail infrastructure (Ministry of Housing and Urban-Rural Development, 2013). The total length of urban rail transit reached 2,408 km in 2013 (National Bureau of Statistics, 2014). Twenty cities have built bus rapid transit (BRT) systems, constituting a total operating length of over 540 km (Institute for Transportation and Development Policy, 2015). Many municipal governments in China have in recent years offered generous subsidies to public transport, maintaining the bus and rail tariffs at considerably low levels. With all these efforts, urban public transport, with urban rail as the representative, appears to be superseding vehicle use growth and is more appropriate for the dense urban fabric and desirable to reduce energy consumption, air pollution and GHG emissions, as the paper by Gao, Newman and Webster in this issue concluded.

Suburban transport is another important part of the transport system, which has not been intensively studied by existing literatures. In the paper by Sun and Doulet in this issue, using community-based mobility services in Shanghai as a case, the authors shared their insights into the flexible and sustainable transport system for suburban China of 2050, with implications on intermodality, transformation of the institutional framework and new market segment for community-based transport.

Fuel economy is one of the essential factors determining energy and environmental impacts of the transport sector. In the early 2000s, China's vehicle fuel economy significantly lagged behind developed countries. The fleet average fuel economy of China's new passenger vehicles was 10% worse than those of Japan and Germany (Oliver *et al.*, 2009). This situation has been largely improved after the implementation of China's fuel economy standards. China issued fuel economy standards for passenger vehicles, light duty commercial vehicles and heavy duty commercial vehicles in 2004, 2007 and 2011, respectively. The fleet average fuel consumption rate decreased from 8.16 L/100 km in 2006 to 7.31 L/100 km in 2013 (iCET, 2014), with the target of reaching 5 L/100 km in 2020. To encourage the purchase of fuel-efficient passenger vehicles, China set a lower purchase tax rate for passenger vehicles with displacement

volumes of 1.6 L or lower from 2009 to 2010. Since 2010, purchases of fuel-efficient vehicles qualify for a 3000 yuan (US$483.9) subsidy. In 2009, the Chinese Government invested 5 billion yuan (US$806.5 million) in accelerating the scrappage of old, inefficient vehicles. However, as Hao *et al.* (2011b) argued, improving fuel economy alone is not enough to achieve the sustainable targets in China's transport sector.

The Chinese Government considers electric vehicles (EV) a priority among the advanced vehicle technologies. In the 'Industry Development Plan for Energy Saving and New Energy Vehicles', the accumulated sales of battery electric vehicles and plug-in hybrid electric vehicles were projected to reach 5 million in 2020 (Chinese State Council, 2012). To achieve this ambitious target, both the central and local governments have implemented a package of measures, including subsidising EV purchase and charging infrastructure construction, and purchase tax exemption, to promote EV market diffusion (Hao *et al.*, 2014). By the end of 2014, 723 charging stations as well as nearly 29,000 charging posts have been built. However, EV sales are far lower than the announced targets, due largely to high vehicle cost, charging inconvenience, and range anxiety. The paper in this issue by Du, Chen, Gao and Ouyang analysed the key factors affecting EV market diffusion, which is of high relevance to both policy-makers and EV manufacturers.

With the rapid growth of China's automotive industry, its environmental and energy impacts are becoming more and more significant, which is of great concern to both researchers and policy-makers, home and abroad. However, existing studies in China's context have not established an integrated system of assessment of the socioeconomic impacts from the production and use of automotive products, making it difficult to achieve optimisation through the industrial chain from a global perspective. In particular, the software platforms for such assessments, which have already been widely used in the US and the EU such as the GREET Model (Wang, 2014), have not been well developed in China's context yet. In the paper by Yin, Chen, Yang, Xie and Liao in this issue, an eco-efficiency assessment system, 'Vehicle-IA system', for the automotive products in China was established, with the aim of guiding the automotive manufacturers to design and produce cars with better socioeconomic impacts.

China's efforts to establish a sustainable mobility system create an opportunity for researchers. Policies need to be developed in the context of China's unique administrative system, which cannot be well adapted by existing studies from developed countries. For example, mandatory policies play an essential role in China's transport policy system, such as the administrative restrictions on vehicle purchase and vehicle use, which have been implemented in many of China's large cities (Hao *et al.*, 2011a). These policies have immediate effects on controlling transport demand. If designed properly, they can improve transport equity as well. However, they are not market-based and may cause overall inefficiency. Besides, these policies are often associated with low public acceptance. Research plays an extremely important role in

evaluating such existing policies and raising recommendations for further improvements. There is large potential for researchers to participate in forming the strategy for sustainable mobility in China. The *Journal of Sustainable Mobility* will continue to serve as a platform for researchers, policy-makers and entrepreneurs to exchange ideas and promote the realisation of sustainable mobility through joint effort.

References

Beijing Municipal Environmental Protection Bureau, 2014. *PM2.5 Source Apportionment in Beijing*, Beijing.

Beijing Transportation Research Center, 2013. *Beijing Transportation Development Annual Report 2013*, Beijing.

Chinese State Council, 2012. *Industry Development Plan for Energy Saving and New Energy Vehicles*, Beijing.

Development Research Center of the State Council, 2009. *2050 China Energy and CO_2 Emissions Report*, Beijing.

Hao, H., Wang, H., Ouyang, M., 2011a. Comparison of policies on vehicle ownership and use between Beijing and Shanghai and their impacts on fuel consumption by passenger vehicles. *Energy Policy*, 39, 1016-1021.

Hao, H., Wang, H., Ouyang, M., 2011b. Fuel conservation and GHG (Greenhouse gas) emissions mitigation scenarios for China's passenger vehicle fleet. *Energy*, 36, 6520-6528.

Hao, H., Ou, X., Du, J., Wang, H., Ouyang, M., 2014. China's electric vehicle subsidy scheme: Rationale and impacts. *Energy Policy*, 73, 722-732.

iCET, 2014. *China Passenger Vehicle Fuel Consumption Development Annual Report*. Beijing.

IEA, 2013. *CO_2 Emissions from Fuel Combustion*, International Energy Agency, Paris.

Institute for Transportation and Development Policy, 2015. *Total Length of BRT Lane*, http://www.chinabrt.org (accessed March 20, 2015).

Ministry of Housing and Urban-Rural Development, 2013. *China Urban Construction Statistical Yearbook 2013*, Beijing.

National Bureau of Statistics, 2014. *China Statistical Yearbook 2000-2014*, Beijing.

Oliver, H.H., Gallagher, K.S., Tian, D., Zhang, J., 2009. China's fuel economy standards for passenger vehicles: Rationale, policy process, and impacts. *Energy Policy*, 37, 4720-4729.

Wang, M., 2014. *GREET.net 2014*, Argonne National Laboratory.

Zhang, M., and Yazdani, B., 2014. Paradigm Change of Mobility in the Twenty-first Century. *Journal of Sustainable Mobility* 1, 9-18.

Dr **Frank (Fuquan) Zhao** is a Professor and Director of the Automotive Strategy Research Institute at Tsinghua University, China, since May 2013. Dr Zhao has published five books and more than 300 academic papers, and owned more than 100 patents. Dr Zhao received many recognitions in his career including but not limited to: Fellow of SAE in 2006, China Automobile Industry Outstanding Person in 2008, CTO of the Year in 2008 and Executive of the Year for Product Planning in 2009 by China Automotive News, the Silver Medal of National Scientific and Technological Progress in 2009, the Gold Medal of China Automotive Science and Technology Progress in 2012, and the Gold Medal of China Enterprise Management in 2012.

State Key Laboratory of Automotive Safety and Energy, Tsinghua University, Beijing 100084, China

zhaofuquan@tsinghua.edu.cn

Dr **Han Hao** is a research assistant at the Department of Automotive Engineering, Tsinghua University. He holds a doctoral degree and a bachelor degree both from the Department of Automotive Engineering, Tsinghua University. His research interests include China's automotive industry development strategy, automotive technology strategy, transport energy system modelling, and transport policy in the context of climate change.

State Key Laboratory of Automotive Safety and Energy, Tsinghua University, Beijing 100084, China

hao@tsinghua.edu.cn

Dr **Michael Zhang** is Reader in International Strategy at Nottingham Business School, Nottingham Trent University. He teaches core modules of International Business and Strategic Management at both undergraduate and postgraduate levels. His research interest covers the following areas: (1) economic development and market process; (2) technology analysis and entrepreneurship; and (3) corporate sustainability and organisational learning. Before his academic career, Michael worked in the automotive industry and was involved in international technological transfer programmes. He has work experience in China, Japan and the UK and speaks Chinese, English and Japanese. Michael has published in a range of economic and management journals, *inter alia*: the *International Journal of Technology Management, International Small Business Journal, Journal of the Asian Pacific Economy, R&D Management, Technology Analysis & Strategic Management*. He served a term of three years, 2011–13, as a member of the Editorial Review Board of the *Journal of International Business Studies*. He was a guest editor for a Special Issue of the *International Journal of Entrepreneurship and Innovation* in 2012. In July 2013 he successfully launched, and became the founding Editor-in-Chief of, a new peer-reviewed journal: the *Journal of Sustainable Mobility* with Greenleaf Publishing.

Nottingham Business School, Nottingham Trent University, Burton Street, Nottingham NG1 4BU, UK

michael.zhang@ntu.ac.uk

Mobility services replace privately owned cars. In the last phase of transport regime change (Phase 3), a new equilibrium has been reachedâ€”bicycles are now used for every second trip; such high levels of cycling already exist in many cities in the Netherlands and Denmark. Bicycle infrastructure dominates cities, including strategically connected bicycle â€œhighways.â€Â This can also be an indicator of how successful managers are in providing a service to their customers because the quality of the service has implications for the demand.Â It is therefore argued that one promising strategy for sustainable transport is to promote higher density development.Â The overall effect is to reduce private vehicle travel and its associated external costs. Sustainable Mobility in China and its Implications for Emerging Economies pp. 6-10(5) Authors: Zhao, Fuquan; Hao, Han; Zhang, Michael. Favourites: ADD. Transport Transitions in Beijing: From Bikes to Automobiles to Trains pp. 11-26(16) Authors: Gao, Yuan; Newman, Peter; Webster, Philip.Â Community-Based Mobility Services as Part of a Sustainable Transport System for Suburban China: The Example of Shared Shuttles (banche) in Shanghai pp. 54-73(20) Authors: Sun, Ting; Doulet, Jean-Franois. Favourites: ADD. About The Journal of Sustainable Mobility pp. 74-74(1). Favourites: ADD. Notes for Contributors pp. 75-75(1). Favourites: ADD. Sign-in.