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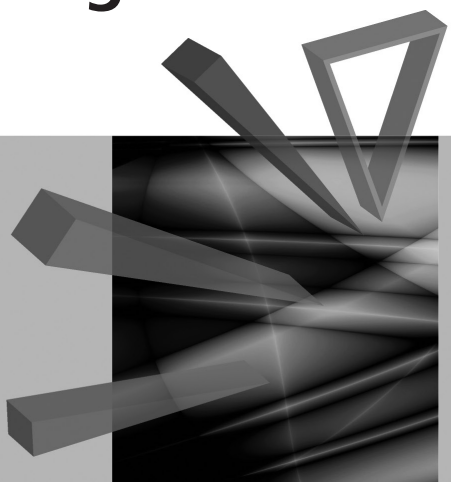
Innovation as a Factor of the Development of the Asia-Pacific Region



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Innovation as a Factor of the Development of the Asia-Pacific Region ISSN 1899-3192

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CHINA'S URBAN TRANSPORT. CHALLENGES AND POLICY ISSUES

Summary: Problems resulting from increasing motorisation in urban areas are known all over the world. Different solutions have been developed in order to meet challenges connected with air pollution, congestion, accidents and other external costs of transport. Rapid socio-economic development in China, accompanied by brisk and uncontrolled urbanisation, strongly influences urban transport systems. This paper is aimed at presenting some current and potential challenges appearing due to changes in urban transport systems in China resulting from rapid socio-economic development, as well as some selected, country-specific solutions aimed at achieving a more sustainable path of development of urban transport.

Keywords: China, urban transport, urbanisation, sustainable transport.

1. Introduction

Transport needs result from nearly every field of human activity. Transportation is indispensable for economic and social development.[1] The intensification of socio-economic life and economic development is an important determinant of demand for transport and its infrastructure. As a consequence, rapidly developing countries are also likely to face a rapid growth of passenger and freight traffic.

China's economy belongs to the group of ten fastest growing economies in the world.[2] The development process is characterised by a rapid and constant increase in passenger and freight transportation. Due to intensive urbanisation processes as well as the phenomenon of urban sprawl, a large share of this growth can be observed in urban areas. Transportation causes positive as well as negative external effects.[3]

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[1] W. Rydzkowski, K. Wojewódzka-Król (Eds.), *Transport*, Wydawnictwo Naukowe PWN, Warszawa 2007, pp. 1–4.

[2] In 2011 China was the fifth fastest growing economy facing a GDP increase of 9.59% (*Top Ten Fastest Growing Economies*, http://www.mapsofworld.com/world-top-ten/world-top-ten-fastest-growing-economies-map.html (accessed: 06.05.2012)).

[3] External effects are a feature of imperfect functioning of markets, described by the European Commission as "the consequences not taken into account by those making decisions on transport" (*Handbook on Estimation of External Costs in the Transport Sector*, produced within the study Inter-

First of all, transport services and development of infrastructure leads to positive external effects (external benefits) in the social sphere (e.g., better accessibility of objects of social infrastructure, access to labour markets and other opportunities to reduce the problem of social exclusion or to reach a place in case of emergency) and the economic sphere (e.g., it is fundamental for the functioning of markets, it enables spatial distribution of economic activity, stimulates mobility of factors of production and division of labour). Negative transport externalities (external costs of transport) embrace, among other things, congestion, air, water and soil pollution, accidents, noise as well as climate change. They not only negatively influence the social and economic sphere (e.g., health problems, loss of production resulting from absence of workers, delays in delivery of raw materials and half-fabricates), but also in the environmental sphere (e.g., the already mentioned pollution, land use, landscape deterioration). The majority of external transport costs are generated by road transport (especially individual motorisation in urban areas), while a negative influence of rail, waterborne and different modes of public transport are relatively less burdensome.[4] Urban areas in China are more and more exposed to various negative transport externalities due to their continuous development as well as increase in the use of road transport. While the negative externalities create large problems right now, when taking an urban transport development path similar to the US or many European countries, China's cities will have to cope with a quickly increasing number of problems in a short time. A solution to these problems is development of urban transport in accordance with the principles of sustainable development as well as implementing environmentally-sound solutions in order to achieve the social and economic goals of current and future generations.[5]

The main aim of this article is to present some current and potential challenges connected with changes in urban transport systems in China resulting from rapid socio-economic development, as well as some selected, country-specific actions, policies and tools aimed at creating a more sustainable development of transport than in the most developed countries. These issues are of great importance in terms of using innovations as a factor in the socio-economic development of China.

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nalisation Measures and Policies for All external Cost of Transport (IMPACT), European Commission DG TREN, Delft 2008, p. 9). Szczepaniak defines external effects as "such effects of economic activity of producers (and consumers), including transport companies, which have an impact on other members of society in an intended or unintended way" (T. Szczepaniak (Ed.), *Transport i spedycja w handlu zagranicznym*, PWE, Warszawa 2002, p. 82).

[4] See for example *OECD Proceedings Towards Sustainable Transportation*, OECD, Vancouver 1996; M. Paradowska, *Rozwój zrównoważonych systemów transportowych polskich miast i aglomeracji w procesie integracji z Unią Europejską*, Wydawnictwo Uniwersytetu Opolskiego, Opole 2011.

[5] The concept of sustainable urban transportation is widely discussed in literature and documents. See, for example, European Commission, http://ec.europa.eu/, OECD: http://www.oecd.org/department/0,3355,en_ 2649_34363_1_1_1_1_1,00.html, World Bank: http://www.worldbank.org/transport/transportresults/documents/ sustain-transp-1996.pdf.

2. Socio-economic development in China

Dynamic socio-economic development of China, a result of strict and consequent plans and policies, is reflected in many numbers and indicators. Some of them are presented in Table 1. China's economy is becoming stronger and stronger, with an annual GDP growth exceeding 10% *per capita* during last decade (over 9% annually since 1978[6]), a gross capital formation rate accounting for nearly 50%, growing net exports[7] and inflow of Foreign Direct Investment. Even the global recession did not hamper the growth pace remarkably.

Table 1. Selected indicators of socio-economic development in China

	2000	2004	2005	2006	2007	2008	2009	2010
1	2	3	4	5	6	7	8	9
GDP (current prices, billion RMB)	9921	15 988	18 494	21 631	26 581	31 405	34 090	39 798
GDP growth rate	8.4	10.1	11.3	12.7	14.2	9.6	9.2	10.3
Growth rate of *per capita* GDP	7.6	9.4	10.7	12.0	13.6	9.1	8.7	9.8
Final consumption rate	62.3	54.4	52.9	50.7	49.5	48.4	48.0	48.1
Gross capital formation rate	35.3	43.0	41.6	41.8	41.7	43.9	47.7	49.3
Value of imports of goods and commercial services, (million USD)	250 688	606 543	712 090	852 769	1 034 729	1 323 843	1 113 234	.
Value of exports of goods and commercial services (million USD)	279 561	655 827	836 888	1 061 682	1 342 206	1 581 713	1 333 346	.

[6] *Urban Transport Climate Change Strategy to Combat in the People's Republic of China*, Asian Development Bank, Philippines, Mandaluyong 2012, p. V.

[7] It is often argued that the "success" of the Chinese economy is driven by net exports. However, some experts claim that it is more a result of investments and domestic demand (An old Chinese myth. Contrary to popular wisdom, China's rapid growth is not hugely dependent on exports, *The Economist*, 3 January 2008, http://www.economist.com/node/10429271 (accessed: 08.05.2012)).

Table 1, cont.

1	2	3	4	5	6	7	8	9
Ratio of Exports of Goods to Imports of Goods (%)	116.1	111.0	111.7	129.0	134.9	133.6	126.1	.
FDI (billion USD) – inflow – outflow	40.715	60 630 5 498	60 325 12 261	63 021 17 634	74 768 26 506	92 395 55 907	90 033 56 529	105 735
Total population (mid-year) in million persons	1263	1296	1304	1311	1318	1325	1331	1338
Urban population in million persons	459	543	562	577	594	607	622	.
Share of number of economically active population to national population	56.9	57.9	58.0	58.1	58.3	58.3	58.4	.
Registered unemployment rate in urban areas (%)	3.1	4.2	4.2	4.1	4.0	4.2	4.3	4.1

Source: *BRICS Joint Statistical Publication 2011*, BRICS 2011, http://www.stats.gov.cn/english/ statisticaldata/otherdata/brics2011/ (accessed: 07.05.2012).

One of the characteristic features of China's development is a rapidly growing urban population. According to the National Bureau of Statistics of China at the end of 2011 over 690 million of people lived in Chinese urban areas in comparison to ca. 656 million in the countryside (the urbanisation rate increased from less than 20% in 1980 to over 50% in 2011). The proceeding urbanisation is considered to be one of the most important factors of the development of the Chinese economy.[8] Huge metropolises with a population near 20 million citizens, like Shanghai, Beijing,

[8] China's urban population exceeds countryside for first time, *Bloomberg News*, 17 January 2012, http://www.bloomberg.com/news/2012-01-17/china-urban-population-exceeds-rural.html (accessed: 12.05.2012).

Guangzhou, Xi'an[9] or "smaller" ones, like Jinan, Zhengzhou, Shenyang or many others, are not only a place to live for more and more people, but also engines of economic growth as well as powerful centres with growing administrative, educational, industrial, housing, cultural and various other functions. As a result, they face a growing demand for transportation.

3. Transport-related problems and challenges in China's urban areas

Migration from rural areas to cities, caused above all by poverty and poor perspectives for a better life, leading to brisk urbanisation in China, has visible and important consequences for transportation in urban areas. The following, mutually related effects, can be distinguished. First of all, the number of urban trips is constantly growing, which is not only a result of higher population density, but also of a higher level of economic activity as well as increasing personal income. For example, in Shanghai the number of personal trips raised from 28.3 million per day in 1995 to 41 million in 2004. In the same period the travel intensity changed from ca. 1.97 to 2.36 trips per day per person, while the average travel distance increased from 4.5 to 6.9 km per trip.[10]

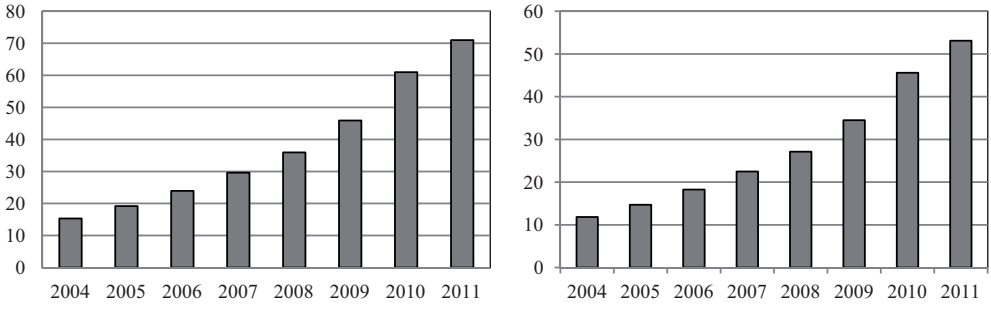

Figure 1. Increase in the number of passenger cars in China between 2004 and 2011 (in million) – left, and average individual motorisation rate (number of private cars per 1000 persons) – right

Source: author's own elaboration based on: *BRICS Joint Statistical Publication 2011*, BRICS 2011, http://www.stats.gov.cn/english/ statisticaldata/otherdata/brics2011/ (accessed: 07.05.2012); Number of private cars in China exceeds 70 million, *People's Daily*, http://english.peopledaily.com.cn/90001/90776/90882/7446381.html (accessed: 10.05.2012).

[9] In 2006 the population density in these cities was 12 901, 9600, 7601 and 5410 inhabitants/km^2, respectively (G. Darido, M. Torres-Montoya, S. Mehndiratta, *Urban Transport and CO2 Emissions: Some Evidence from Chinese Cities. Working Paper – June 2009*, World Bank, 2009, p. 3, http://documents.worldbank.org/ curated/en/2009/06/12568255/urban-transport-co2-emissions-some-evidence-chinese-cities (accessed: 10.05.2012).

[10] D. He, F. Meng, M.Q. Wang, K. He, Impacts of urban transportation mode split on CO2 emissions in Jinan, China, *Energies* 2011, Vol. 4, p. 686, http://www.mdpi.com/1996-1073/4/4/685 (accessed: 10.05.2012).

Another sign of socio-economic development in Chinese urban areas is changes in the modal split. While walking, cycling and public transport[11] are still popular ways of travelling, cities (especially "bigger" ones) face a rapid growth of motorisation (see Figure 1 and 2). The number of vehicles in China increased from about 1 million in the early 1990s to nearly 61 million in 2010. The annual growth rate of registered private vehicles accounted for 25% between 2001 and 2010.[12] Thus, the modal split in urban areas changes inexpediently. In Shanghai in the period between 1986 and 2004 the share of non-motorised transportation (NMT) decreased from 72% to 59.8%, while private car use increased from less than 3% to 16.5%. In Beijing the individual motorisation rate increased from 5% in 1986 to 23.2% in 2000 and to

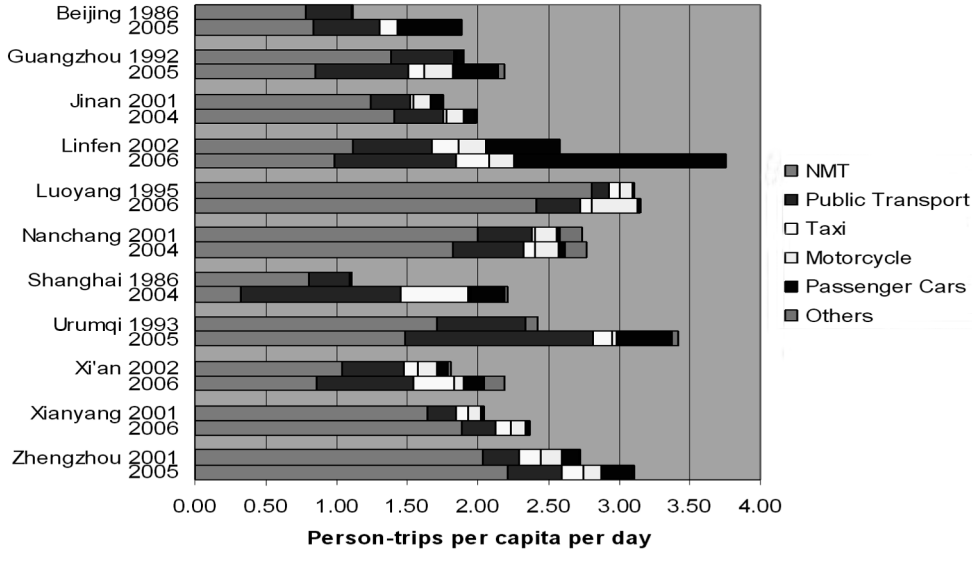

Figure 2. Examples of changes in modal split in urban transport in China

Source: G. Darido, M. Torres, S. Mehndiratta, *Urban Transport and CO_2 Emissions: Some Evidence and Trends from Chinese Cities. Working Paper 55773*, World Bank, 2009, http://documents.worldbank.org/curated/en/ 2009/06/12568255/urban-transport-co2-emissions-some-evidence-chinese-cities (accessed: 10.05. 2012).

[11] In order to reduce negative impacts of transport, more environmentally-sound modes of transport should be used, while reducing the share of individual motorisation. In urban areas the most sustainable ways of travelling are walking, cycling and public transport (rail, metro, tram, bus). However, in China also motorcycles are in common use with different shares in the urban modal split, depending on a city.

[12] G. Darido, M. Torres-Montoya, S. Mehndiratta, *op. cit*., p. 3.

29.8% in 2005,[13] which is the highest among Chinese metropolises. Moreover, in the Chinese capital about 1% of China's population drives 10% of China's vehicles.[14]

The trends already described are common for all Chinese urban areas and are likely to be strengthened, resulting in more serious transport-related problems, which are becoming more and more important on the policy agenda of municipalities as well as the central government. According to the forecasts made more than a decade ago, the number of civil vehicles was expected to increase to ca. 130 million and the number of private cars to ca. 80 million by 2020. The number of vehicle trips per day was expected to grow by 9% annually.[15] However, in reality it turned out that the real growth of motorisation is much faster.

One of the most significant challenges in the sustainability of transport is dynamically increasing energy consumption in China, which became the world's biggest energy consumer in 2010. Between 1980 and 2006 total oil consumption in China increased on average by nearly 6% annually (an overall increase of 300%). Transport is responsible for nearly 30% of this consumption.[16] The rapid increase in the use of gasoline- and diesel-powered cars can become a real barrier for development processes, not only because of oil prices and energy use, but also because of exhaust emission. Air pollution is considered as one of the main causes of deaths in Chinese urban areas, being responsible for over 400 000 premature deaths each year. In cities, vehicles' emission is one of the main sources of air pollution.[17] It was estimated that in Tianjin, a city near Beijing, in 2003 air pollution caused a loss of 3.7% of city's GDP in terms of health costs.[18] Accidents are another serious problem for Chinese municipalities. Though the number of road fatalities in China decreased from near 94 000 in 2000 to near 68 000 in 2009, and the number of people injured from ca. 419 000 to ca. 275 000,[19] still the average mortality rate is very high (5–8 persons killed per 1000 motor vehicles).[20] Congestion as an external cost with a mainly

[13] D. He, F. Meng, M. Q. Wang, K. He, *op. cit*., p. 686.

[14] F. Creutzig, D. He, Climate change mitigation and co-benefits of feasible transport demand policies in Beijing, [in:] *Transportation Research Part D: Transport and Environment*, 2008, ELSEVIER, http://www.journals.elsevier.com/transportation-research-part-d-transport-and-environment/#description (accessed: 10.05.2012).

[15] WU Hongyang, *Benchmarking Efficiency of Sustainable Urban Transport in China – 7 Challenges and 5 Priorities*, China Academy of Transport Sciences, 2009, http://www.its.berkeley.edu/volvocenter/VREF/N1_CUSTReC.pdf (accessed: 10.05.2012).

[16] *Urban Transport Strategy to Combat Climate Change in the People's Republic of China*, Asian Development Bank, 2012, pp. 2–3.

[17] J. Watts, China: the air pollution capital of the world, *The Lancet* 2005, Vol. 366, pp. 1761–1762, cited by: F. Creutzig, D. He, *op. cit*.

[18] Y. Zhou, R.S.J. Tol, *Valuing the Health Impacts from Particulate Air Pollution in Tianjin. Working Paper 89*, Forschungsstelle Nachhaltige Umweltentwicklung, 2005, <http://www.fnu.zmaw.de/fileadmin/fnu-files/publication/working-papers/WP_FNU89_Zhou.pdf> (accessed: 10.05.2012).

[19] *BRICS Joint Statistical Publication 2011*, BRICS 2011, http://www.stats.gov.cn/english/ statisticaldata/otherdata/brics2011/ (accessed: 07.05.2012).

[20] W. Hongyang, *op. cit*.

local negative impact increases the levels of many other externalities significantly. Furthermore, it leads to a lower average car travel speed at peak hours (ca. 12 km/h in Beijing and 9–18 in Shanghai in 2006[21]), lower average speed of public transport buses (about 9.2 km/h in Beijing and 10 km/h in Shanghai[22]) and a significant reduction in local GDP. Overall external costs in Beijing in 2005 accounted for estimated 7.5––15% of the city's GDP. Climate change, resulting from transport-related greenhouse gasses emission, is a global concern, involving international organisations, such as the United Nations, World Bank or Asian Development Bank.

When the current trends in urbanisation and motorisation will continue, the discussed negative externalities of urban transport in China are likely to increase significantly. They not only may threaten China's socio-economic development itself, but also the development of, in particular, its neighbouring countries. A different path of urban transport development should be taken than the one in US or in Western European cities, where problems are similar, although car use is much greater and urbanisation processes and motorisation growth relatively stable. According to Hongyang,[23] there are some main challenges to overcome in order for Chinese cities to enter a path of a more sustainable development of urban transport: (i) capacity building for adaptation to socio-economic needs, (ii) reducing congestion and improving transport efficiency, (iii) fulfilling social needs connected with car usage while reducing its negative impact, (iv) improving the reliability and service quality of the public transport, which would support socio-economic development, (v) reducing external costs of transport and creating clean and healthy transport systems, (vi) improving social equity by providing multi transport services, (vii) providing safer urban road and transport systems.

All these goals can be achieved by using different instruments, including infrastructure solutions, innovations, changes in norms and regulations, educational actions, etc. Many of them are already implemented in developed countries. However, the pace of urban transportation growth in China requires some more effective and efficient tools, aimed at impeding objectionable development trends in urban transportation and reducing its negative impact in a short time.

4. Selected solutions aimed at improving transportation performance in China

Many instruments have been developed with the aim of creating more sustainable urban transport systems. In many European and North American cities external

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[21] J. Pucher, Z.R. Peng, N. Mittal, Y. Zhu, N. Korattyswaroopam, Urban transport trends and policies in China and India: Impacts of rapid economic growth, *Transport Reviews* 2007, Vol. 27, No. 4, pp. 379–410, http://policy.rutgers.edu/faculty/pucher/PUCHER_China%20India_Urban%20Transport.pdf (accessed: 10.05.2012).

[22] Z.-R. Peng, *Urban Transportation Strategies in Chinese Cities and Their Impacts on the Urban Poor*, wilsoncenter.org/sites/default/files/Edit6Peng_Delhi.doc (accessed: 11.05.2012).

[23] W. Hongyang, *op. cit*.

costs of transport resulting from increasing motorisation became a serious problem a few decades ago. Chinese municipalities can learn from their experience as well as a wide range of tested and successful solutions. However, there are some reasons why a slightly different approach towards urban transport problems is required in the case of China. First of all, the modal split is still relatively advantageous in terms of sustainability. Therefore, actions should be undertaken in order to encourage people not to resign from non-motorised transportation or public transport, while improving public transport at the same time. Furthermore, low-income groups account for a noteworthy share of the urban population in China and their mobility needs, though smaller than in the case of richer citizens, should also be met. Another important challenge is to convince people with increased personal income not to use private cars. However, as already mentioned, the population size and density itself is a determinant of problems in Chinese urban transport systems. In addition, China alongside with the US is currently the most attractive car market in the world, while the growing automobile industry is an important part of the Chinese national economy. While this certainly can reduce policy effectiveness, it can also create an opportunity for innovations in car construction, under the condition of a strong policy with sustainable mobility priorities.

Creating urban transport capacity meeting the challenges of a rapid socio-economic urban development, mainly by constructing and improving transport infrastructure and public transport, was one of the first steps taken by municipalities in the biggest Chinese cities at the turn of the 21st century. An example is the Smooth Traffic Project, which was initiated by 36 cities in 2000 and by other cities in the following years. Many of them adopted special transport system development plans in order to meet an increasing demand for mobility among citizens. However, the top priorities were the development of expressways, subways, light rails and rapid bus transit systems, while traditional non-motorised modes were neglected or even discouraged because they were considered as impeding road traffic flows or as outmoded.[24]

In 2006 a World Bank report was published on the causes of China's urban transport problems with a list of actions and instruments to implement in order to handle the situation.[25] Emphasis was put on strengthening the role of the national government as well as local governance structures for urban transport, developing institutional capacity, a sustainable and transparent financing mechanism and a viable public transport sector as the core of urban transport services. Moreover, the conflicts signalised above between the goals of sustainable transport and the growing car market and automobile industry in China were taken into consideration.[26] Innovations such

[24] Z.-R. Peng, *op. cit*.

[25] *China. Building Institutions for Sustainable Urban Transport. East Working Paper No. 4*, World Bank, Transport Sector Unit, Infrastructure Department, 2006, http://www.worldbank.org/transport/transportresults/ regions/eap/china-bldg-inst.pdf (accessed: 10.05.2012).

[26] *Ibidem*, pp. 14–26.

as the development of small and fuel-efficient vehicles may solve many problems.[27] Along with "traditional", tested and more or less successful solutions, more and more widely applied in developed countries around the world, a fresh and country-specific approach should be developed because of the individual and distinctive situation of Chinese urban areas. Focus should be on integrated solutions with a strong local and governmental policy reinforcing or even guaranteeing effectiveness of instruments, such as intelligent transport systems, infrastructure improvement and facilities, green zones, emission norms,[28] car-sharing, changing mental models regarding the use of more sustainable modes of transport (or not allowing them to change into inexpedient ones with increasing wealth), restriction for car users, and many others. Financial instruments connected with internalisation of external costs and technological innovations, which are of great importance in terms of the scale of transport challenges in China, may be one of the most significant solutions.

As describing all the methods and tools used in China in order to achieve a more sustainable development of transport is not the core aim of this paper, focus will be on some instruments developed in a slightly different way than in the most developed countries, namely charges as a part of transport demand management and technological innovations.

The strong increase in the number of vehicles in urban transportation is the main source of most external transport costs in China. For this reason, some initiatives were undertaken with such management of transport demand as an objective that would discourage people to buy new cars. The car license plate quota auction system implemented in Shanghai is an example of an innovative charging system for car buyers. During the auction participants compete for a possibility of buying and registering a new car – the one who pays more, wins. The number of licenses is controlled by the Shanghai municipality. Thanks to the system, the number of cars in the city was reduced by about 1.5 million. In 2007, the average daily increase in the number of motor vehicles in Shanghai was 380 (in Beijing about 1050).[29] A slightly different solution was implemented in Beijing in 2010, where the number of vehicles exceeded 4.5 million. In January 2011, in accordance with the Beijing policy on vehicle ownership control, a lottery system to allocate vehicle license plate quota to new car buyers was introduced. However, both the license and lottery systems are prone to speculations, as the number of winnings is much higher than the number of actual buyers of cars, which has a negative influence on the car industry. Moreover, there is a lack of research on the policy's effects and consequences, as well as the

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[27] However, this could lead to further growth of individual transport and final effect can be ambiguous.

[28] Implemented, e.g., in Shanghai and Beijing at the end of 1990s and improved like EURO (J. Yulin, L. Zhenyu, Practices and policies of green urban transport in China, [in:] *Journeys*, May 2010, http://www.ltaacademy.gov.sg/LA-01Journeys_May10_files/J10May-p26Jiang&Li_GreenTransport-China.pdf (accessed: 08.05.2012)).

[29] *Ibidem*, p. 30.

public reaction to the policy.[30] It seems that social acceptance as a part of social capital necessary for sustainable transportation is neglected. The management of transport demand assumes also another restriction for car owners in Beijing, namely the prohibition of car travelling during particular days of a week depending on the license plate number. In the period between 2007 and 2009, though the number of cars increased, the traffic jam index as well as duration of traffic jams decreased. Actions at the local level are also supported by the central government. In 2008 a special consumption tax was introduced. The tax rate on large passenger cars (3.0–4.0 litres) increased from 15% to 25%, while the tax for cars above 4.0 litres was raised from 20% to 40%. Simultaneously, the consumption tax rate on small passenger cars (below 1.0 litre) was reduced from 3% to 1%. Effects were visible in the same year: the sales of small passenger cars, accounting for 61.5% of the annual vehicle sales, increased by 18%, which was much higher than the average for the total vehicle market. Furthermore, in 2009 the vehicle purchase tax for small cars was reduced from 10% to 5%. At the same time, a fuel consumption tax was implemented in order to promote sustainable consumption patterns, stimulate innovations in car technology and stimulate the use of smaller cars.[31]

Emphasis on small and environmentally-sound vehicles is characteristic not only in the area of transport demand management, but also – or above all – in the area of research and development. Besides stimulating the development of low-emission vehicles using alternative fuels (e.g., fuels not based on oil products), much pressure is on developing electric vehicles. This trend can be observed since the middle of the 1990s and is supported by many policy plans, domestic funds and international loans and projects (e.g., from the World Bank and Asian Development Bank) with fruitful results presented during latest world exhibitions.[32] As a result, China is becoming a new technological leader in the production and development of electric vehicles (for private, civil and public transport), next-generation automotive batteries, electric two-wheeled bikes and motorcycles.[33] Local and central government support plays a crucial role in this process, also in terms of implementing its effects in urban transportation, e.g., by means of the electric vehicle demonstration project,

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[30] J. Zhao, *Car Ownership Polices and Public Acceptance in China, the University of British Columbia*, 2012, http://www.scarp.ubc.ca/research/physical-planning-transportation-and-urban-design/car-ownership-policies-and-public-accepta (accessed: 11.05.2012).

[31] J. Yulin, L. Zhenyu, *op. cit*., pp. 30–31.

[32] See, for example, S. Mehndiratta, *The China New Energy Vehicles Program Challenges and Opportunities*, World Bank, 2011, http://siteresources.worldbank.org/EXTNEWSCHINESE/Resources/3196537-1202098669693/EV_Report_en.pdf (accessed: 11.05.2012); S. Ji, C.R. Cherry, M. Bechle, Y. Wu, J.D. Marshall, Electric vehicles in China: Emissions and health impacts, [in:] *Environmental Science and Technology*, 2011, American Chemical Society, http://personal.ce.umn.edu/~marshall/Marshall_34.pdf (accessed: 11.05.2012).

[33] D. Gordon, *Following China's Lead Transforming Transportation*, World Bank 2009, http://blogs.worldbank.org/eastasiapacific/following-china-s-lead-transforming-transportation (accessed: 11.05.2012).

Ten-Cities, Thousand Units, which aims to implement and promote electric vehicles in public transport, taxis, etc. in Chinese cities.[34]

Although the presented examples do not provide a complete overview of sustainable urban transport oriented solutions in China, they show some differences in policy focus, actions and goals between China, as a developing country with a great potential but also great challenges in urban transportation, and other countries. The innovative attitude, based on strict instruments aimed at the management of mobility demand or huge investments in new technologies, has its direct and visible effects.

5. Concluding remarks

Although China's problems in urban transport seem to be very specific and resulting from a rapid socio-economic growth and quick urbanisation, there are some elements in urban transport policy which can be useful for transport policy for other developing but also developed countries. First of all, more sustainable development of urban transport is not only of great concern for the local, but also for the central government, allowing for the development of integrated, interrelated instruments, such as tax policy and constraints on car usage. Secondly, many of the most effective tools are based on direct restrictions for car owners and drivers with a relatively low level of social opposition. However, such restraints could be rejected or ignored by societies with a more developed democracy.[35] Thirdly, technological innovations, which seem to change the face of today's urban transport, are supported by the local and the central government in many ways – investments, international loans, demonstrative projects, etc. – in each phase of the product cycle, from a concept to commercialisation.[36] This multilevel and integrated approach, accompanied by consistence and determination, can be considered as country-specific, and most probably results from the scale of problems as well as the scale of future threats. However, because of some visible and advantageous effects in the context of more sustainable urban transport, they can be an attribute to follow in the benchmarking process, if developed countries would decide for the opposite benchmarking, where China would be an example to follow.

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[34] J. Yulin, L. Zhenyu, *op. cit*., p. 32.

[35] However, as charging systems in Stockholm and London City show, social acceptance can depend on solutions' results and its organisation.

[36] Like in the case of a three-dimensional bus for public transport proposed by Shenzhen Hashi Future Parking Equipment Co., Ltd, which is started to be implemented in Beijing (W. Wlizlo, *A Radical Public Transportation Solution Straight Out of a Sci-Fi Novel*, UTNE Reader, 2010, http://www.utne.com/science-and-technology/public-transportation-solution-straddling-bus.aspx#ixzz1uZIVNJn9 (accessed: 11.05.2012)).

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TRANSPORT MIEJSKI W CHINACH. WYZWANIA I PROBLEMY

Streszczenie: Problemy wynikające z rosnącej motoryzacji na obszarach zurbanizowanych są powszechne na całym świecie. W celu ograniczenia zanieczyszczeń powietrza, kongestii, wypadków i innych kosztów zewnętrznych transportu opracowano wiele rozwiązań. Gwałtowany rozwój społeczno-gospodarczy w Chinach i charakterystyczny dla niego szybki i niekontrolowany proces urbanizacji silnie oddziałują na miejskie systemy transportowe. Niniejszy artykuł ma zasygnalizować pewne istniejące oraz potencjalne wyzwania związane ze zmianami systemów transportu w miastach chińskich, a także pewne wybrane, specyficzne rozwiązania ukierunkowane na bardziej zrównoważoną ścieżkę rozwoju transportu miejskiego.

Słowa kluczowe: Chiny, transport miejski, urbanizacja, zrównoważony transport.