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Developmental pattern and international cooperation on intelligent transport system in China

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ABSTRACT

Transport plays a key role in our lives, transforms our outlook and has a massive impact on social and economic development. In addition, emerging of the technologies are also associated with the social and economic development. Accordingly, Intelligent Transport System (ITS) has evolved with Chinese social and economic transformation. In the 1990s, China started a large-scale construction of road infrastructure, and ITS was considered as a futuristic and expensive tool box. It was crucial for Chinese government to identify when and how to integrate new technologies into transportation systems and to formulate an appropriate development strategy, especially with ITS. Through more than 20 years development, Chinese ITS has gained remarkable achievements. This paper will firstly review the policy, strategy and experience of ITS development and deployment in China, then its import as well as the international cooperation and cases will be illustrated, and finally conclusions and experience will be presented, in particular to other developing countries, on ITS development.

1. Introduction

Transport plays a key role in our lives. The development of transport is closely associated with the progress of social and economic development and globalization. Efficient, convenient, mobility, safety and environment friendliness become key issues for transport system, and its development must consider the need for effectiveness of their operation coupled with limiting negative consequences. The Intelligent Transport System (ITS) has been foreseen as a solution facing to the growing demands of modern transport system. It could be applied to improve the efficiency of transportation network from the system point of view. Thus the implementation of ITS is such a solution which obtains strong supports by most countries and regions.

As same as other scientific technologies, the emerging of ITS is an inevitable outcome at a certain stage of social and economic development. Developed countries and regions, including the United States, Japan and Europe, completed their constructions of road network and began to research and develop ITS systems in the 1990s. At that time, China just started the large-scale construction of road infrastructure, and ITS was considered as a future and expensive tool box. Chinese government and experts believed that China's development should take a new path, which made it be crucial for identifying when and how to integrate new technologies with transportation and formulate an appropriate development strategy (Yao et al., 1998). Besides, the Chinese government and experts not only wanted to study the technology and experience from developed countries, but also how to design useful systems and to select suitable technical schemes. In order to achieve this goal, international cooperation was considered as an import part in Chinese ITS development and deployment.

The purpose of this paper is identify the developmental pattern and to summarize the experience and effect of international cooperation in Chinese ITS development. In the following section, a review of ITS policy history in China and why the three step development strategy was selected are presented. In Section 3, some important international ITS cooperation projects in the implementing the development strategy are illustrated and analyzed. Finally, Section 4 provides some conclusions and suggestions.

2. China ITS policy and development strategy

In 1995, the Chinese government planned the development program for the next 5 years, and the Ministry of Transport (MOT) promoted researches of transport technology, as corresponding for the plan (Ministry of Transport, 1995). Based on the experience in

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road traffic engineering and the international exchange of technology, experts proposed that ITS technology would be an important future technology and the intelligence should be considered as the future direction of transport development. At the end of 1995, the MOT issued the "9th Five-Year (1996–2000) Plan and 2010 Long-Term Plan for the Development of Highway and Water Transportation Technology", which intend to establish a national level ITS research center and a MOT ITS laboratory by 1999, and to governmentally organize the ITS development strategy research and international cooperation on ITS.

2.1. The concurrent mode of infrastructure construction and ITS technology application of China

Since the onset of economic reforms in early 1980s, China has experienced rapid economic growing with increase in prosperity and income levels of citizens. Realizing that transportation infrastructure forms the important backbone of the country's economy, Chinese government has earmarked substantial share of total investment in transportation infrastructure. Some of the foreign experience of ITS development were also imported to China. Thus, in "The Study of ITS Development Strategy in China" project, launched by then MOT from 1996, a consensus amongst the Chinese government and experts was that the application of ITS has no need to wait until the completion of the road infrastructure construction (Yao et al., 1998), and it would be more economic to initiate the ITS system during the designing and constructing phases of infrastructure development. For example, when constructing an expressway, it must be more economic to install an optical fiber cable communication system and traffic data collecting system along the roadway, than facilitating them after the construction is completed. In addition, it was believed that with an appropriate system architecture, some ITS applications can be applied in advance, rather than waiting until the whole ITS system is formed. Thus, in order to achieve such an architecture for China, three works was done by the National ITS Center of China. The first one designed the national ITS architecture, as well as an implementation schedule for projects and services. The second one formulated the national ITS standard system and its deployment plan. And the third one carried out an international technical exchange and cooperation.

2.2. The implementations fitting to the development stage and user demand of China

Liu (1999) developed a Cobb-Douglas production function based model to analysis the relationship between road length and GDP per capita. As shown in Table 1, from 1985 to 1995, with the economy development, the GDP per capital in the United States, the United Kingdom and Japan were between 10,000–40,000 USD, but the total length of highway in those countries increased slightly which indicated that the national-wide road networks in those countries were well constructed. More attentions were switched to use the ITS technology to improve and reform the transport system with the well-constructed road network.

Since 1995, China began to follow up with the world development of ITS. In a different manner of those developed countries, China is the biggest developing country in the world, the GDP per capita in China was 607 USD and the construction of highway in China was at the very beginning at that time, As shown in Table 2. Compared with the typical developed countries in Table 1, in 1995, the total length of highway and expressway in China were only 1.157 million kms and 2100 km, which were around one fifth of the total length of highway and one thirty-second in The United States. The total automotive number of the nation and the road infrastructure were relatively low in China.

Table 1
Summary of GDP, Highway, Expressway and Automobile in the United States, the United Kingdom and Japan.

	Year	GDP[a] (Billion USD)	GDP per Capita[a] (USD)	Highway[b] (million km)	Expressway[b] (km)	Automobile[b] (million)
The United States	1985	4350	18,269	6.2183	81,685	177.1332
	1990	5980	23,954	6.2232	84,880	193.0573
	1995	7660	28,782	6.2961	88,053	205.4272
	2000	10,300	36,450	6.3347	89,426	225.8212
	2005	13,100	44,308	6.4303	92,002	247.4211
	2010	15,000	48,374	6.5453	99,005	250.07
	2014	17,400	54,630	6.7223	1,04,466	255.8768
	Year	GDP[a] (Billion USD)	GDP per Capita[a] (USD)	Highway[c] (million km)	Expressway[c] (km)	Automobile[c] (million)
The United Kingdom	1985	489	8652	0.3487	2,813.2	21.2
	1990	1090	19,095	0.358	3,069.8	24.7
	1995	1240	21,330	0.3864	3269	25.4
	2000	1550	26,401	0.3902	3467	28.9
	2005	2420	40,048	0.3881	3518	32.9
	2010	2400	38,293	0.3943	3558	34.1
	2014	2990	46,332	0.3956	3645	35.6
	Year	GDP[a] (Billion USD)	GDP per Capita[a] (USD)	Highway[d] (million km)	Expressway[d] (km)	Automobile[d] (million)
Japan	1985	1380	11,466	1.127	3555	48.241
	1990	3100	25,124	1.114	4661	60.499
	1995	5330	42,522	1.202	5700	70.107
	2000	4730	37,300	1.226	6600	75.525
	2005	4570	35,781	1.253	7400	78.992
	2010	5500	42,909	1.269	7800	78.661
	2014	4,600	36,194	1.273	8400	80.670

[a] World Bank Database.
[b] Bureau Of Transportation Statistic, U.S. Department of Transportation.
[c] Transport Statistics Great Britain 2015.
[d] Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan.