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Paper title: **ITS deployment and transportation policies**

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Abstract (200 words):

Technology has driven the mobility needs of people and has been critical in the movement of goods. The newest wave of transportation technologies is the development and deployment of intelligent transportation systems. For the last 15 years, these systems have been promoted by the private industry and the public sector, mainly Departments of Transportation. The academia has also been involved as a developers and evaluators of technologies. However, the progress of ITS implementation has been relatively slow. In this paper, we review the progress and provide a sense of future direction. The paper is meant to encourage debate and expresses the opinions of the authors

Historical background

For more than fifteen years Intelligent Transportation Systems have been in the fore front of transportation players' activities including the transportation industry, the transportation service providers, the academic research as well as the public sector and local authorities in charge of transportation. The ITS stakeholders come from a broad spectrum and communicate across continents and they play an important role in the discussions concerning the future of transportation.

During the past fifteen years, ITS has been publicized as having a positive role in solving transportation problems. However, the question is: What do we know about the importance of this role? Given that transportation is intertwined with the social and economic system, what do we know about the social effectiveness and economic impact of ITS deployments? What are the new directions for the future? The overall aim of this paper is to present an analysis of transportation trends and to highlight the necessity of clear transportation policies to support successful ITS deployments.

To understand the context in which ITS are being implemented, we must look at the major changes and shifts that the current population has experienced during the past 20 to 30 years. These include:

- Increased access through new transit lines (TGV, LRT), purchase of cars and more air travel.
- Changes in lifestyle choices (family formation—people are getting married late and having fewer children and family size is decreasing) and location choices (home and work locations are increasingly separated with people moving to the suburbs), and income levels that have been increasing substantially. Higher incomes result in greater access to automobility and more travel to participate in activities.
- Increased information/communication from the Internet and cellphones.
- Integration of transportation and information/communications technologies resulting in greater flexibility of travel, e.g., easier reservations, use of Mapquest or Michelin for directions to destinations, and radio traffic information.
- Presence of improved weather forecasts and information.
- Easier management of money through credit cards.
- Electronic fare and toll payment systems.

On the one hand, demand for travel is increasing, e.g., due to higher incomes and on the other it is decreasing, e.g., due to electronic transactions. Nevertheless, traffic congestion, safety and other problems persist in urban areas. In this context, ITS has been presented as a main tool to improve road congestion, safety and the environment.

Safety, congestion, environment: The ITS trilogy

What are the trends concerning congestion, safety and environmental issues? A brief analysis of the situation in three different countries, France, Japan and the United States, has been conducted by Ygnace, Khattak, Uno (2004). It shows that the transportation situation was improving long before that ITS becomes a reference in transportation

Road safety trends

Rate of fatality: presented for each country from 1975,
Figure 1.

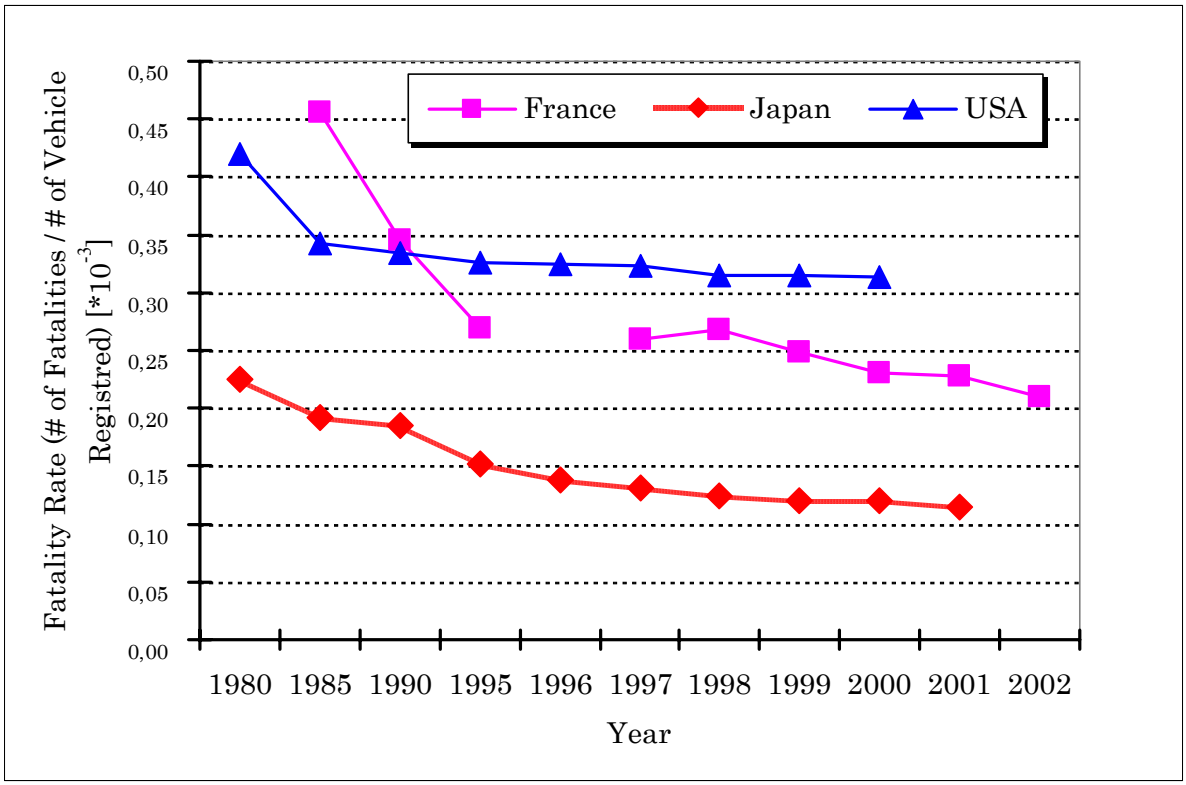

Figure 1 Rate of fatality caused by traffic accidents

- Traffic safety in France seems to improve gradually, because the number of fatalities above continues to decrease from 1980.
- Traffic safety in USA tends to improve also, although the number of fatalities seems to be stable after 1995.
- Traffic safety aspect of Japan seems to follow the same positive trend when considering fatalities only after 1990.

We present here the rate of fatalities per registered cars. Interestingly, the trends remain the same if we consider the absolute number of fatalities or even the rates by 100.000 Vehicle-Kilometers Traveled.

Traffic congestion

Travel speed,
Figure 2: the following chart shows both the travel speed of automobile in Paris and Tokyo and the nationwide commuting speed in USA.

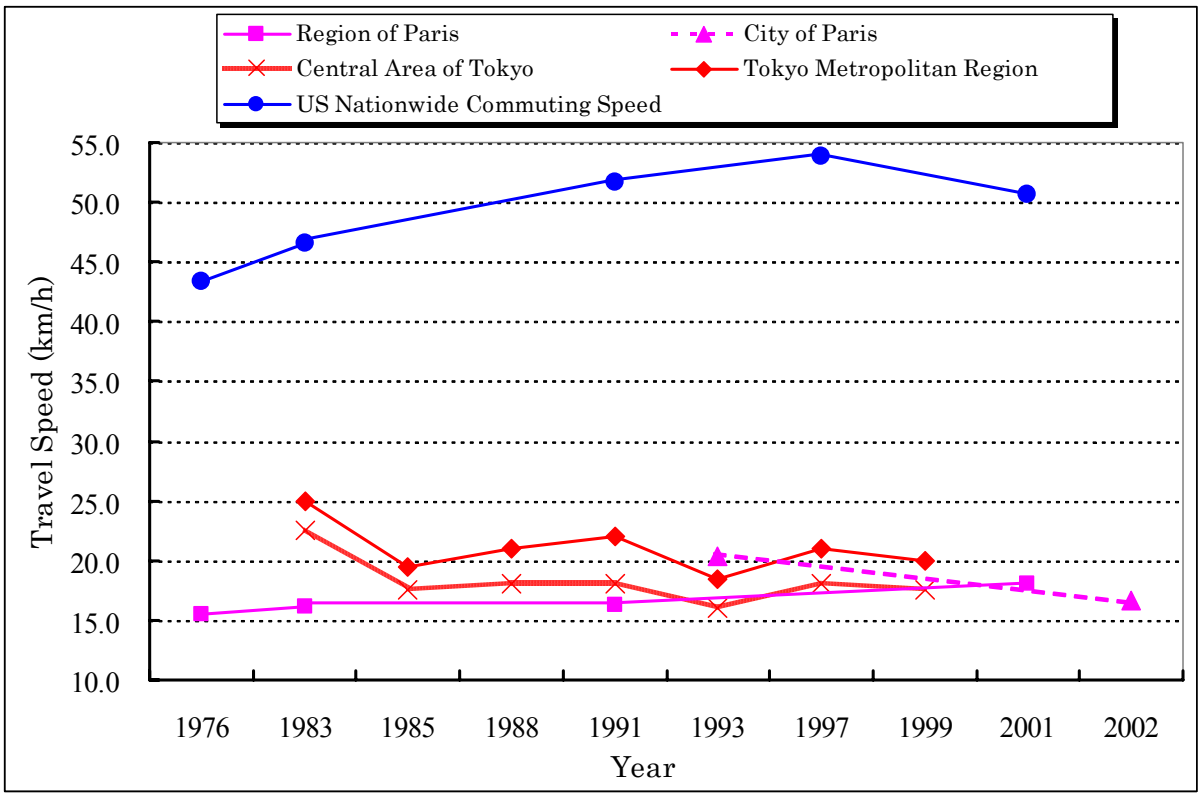

Figure 2 Travel speed in Paris and Tokyo and commuting speed in USA nationwide

- U.S. nationwide commuting speed tends to increase year by year till the mid 90's. They decreased by around 9% since then. Interestingly and according to the 2000 U.S. census commuting results, the trend is the same in both rural and urban areas.
- Travel speed of Both Paris and Tokyo cities seems to be stable and we can observe a moderate increase for the urban region of Paris.

Environment

CO_2 emission, Figure 3: the following chart indicates both total CO_2 emission and one produced by transportation.

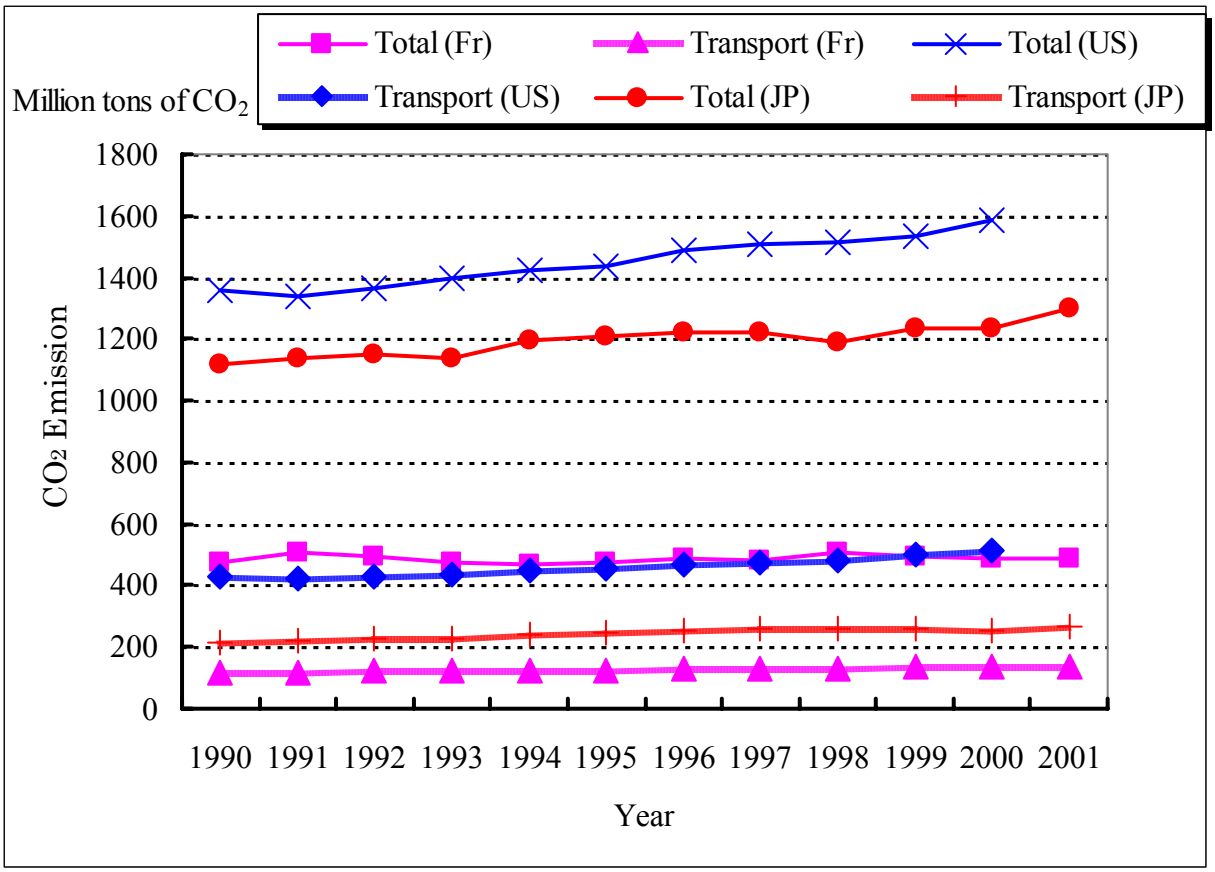

Figure 3 CO_2 emission (total & transportation-produced)

Although global CO_2 emissions seem to be almost stable for three countries, CO_2 produced by transportation tends to increase gradually in both USA, Japan and France to a lesser extent. Interestingly, the environmental issues of ITS, although always presented as important, get little attention within the ITS experiments and deployments. Congestion and safety related ITS technologies are far more prevalent.

Given these trends, perhaps ITS are not unique and dedicated solutions to address safety, congestion and environmental problems. ITS can only be presented as a tool to accompany or at least dramatically increase exiting positive trends the nature of which being related to other actions role.

ITS and transportation policies

We view transportation policies as a plan of action adopted or pursued by a government for tackling relevant issues. ITS are a set of technological tools intended to achieve the societal goals and intertwining them with conventional policies can result in non-incremental changes. Many examples can support this hypothesis; we will focus on two of them.

Road safety, a French example

As shown in Figure 1, the fatality rate has been steadily decreasing in France since 1990 from 035 to .20. It represents, in absolute numbers, from 10651 fatalities/year to 8414 in 2002 (a reduction of 21% in 12 years). In 2003, the French DOT and the department of interior in charge of road police, decided to tackle the safety issue by focusing heavily on speed enforcement. Instead of relying on the strategy to deploying more police along the freeways, they decided to use a sophisticated automated enforcement technology. As the name suggests, such systems snap photographs of vehicles in the act of a specific traffic violation. Photographs are usually taken of the rear license plate and matched against a State's Department of Registered Motor Vehicle database. The registered owner of the vehicle is then mailed a ticket or other notification that an infraction has occurred.

The latest statistical results show a national decrease in fatalities of 20.9% in one year http://www.securite-routiere.gouv.fr/. Therefore, combining a conventional enforcement strategy with a technological solution resulted in a dramatic decrease of the fatalities. These results were obtained with only 100 radars deployed on major urban and intercity freeways. Based on the success of this ITS enforcement strategy, 1100 more radars will be deployed in the coming year. In the past many "traditional" enforcement policies have been implemented and tested in France. They never showed such a drastic improvement. More time is necessary to validate the impact of the new strategy but it is the first time the results are showing positive effects over such a long period of time.

Figure 4 Radar equipped with a camera deployed on French freeways

Traffic congestion, a British example

The city of London decided in 2003 to charge every automobile a fee to use the roads in the core center of the city as a tool to reduce the number of automobiles using the streets. Mayor Livingston campaigned vigorously on the issue of congestion pricing and the program was initiated shortly thereafter. The rules to the system are easy to learn and obey. Before entering the inner ring of London, denoted by crossing Inner Ring Road (also by crossing the painted "C" on the street), drivers must buy a pass to drive within the area. The cost is about 8 dollars a day during the peak hours between 7:00am and 6:30pm on weekdays. The price does not fluctuate with the level of congestion or personal use. If drivers do not pay ahead of time, they are subject to a ticket and/or a tow. Taxis, buses, and motorcycles are exempt from the fee. All cars are monitored by cameras that record license plate numbers and compare them with paid license numbers.

After more than six months of implementation the main results described by Paulo Camara and Laura Valente de Macedo (2004) show that there are about 60,000 fewer daily car movements entering the zone. Overall there has been a reduction of 30% in car movements and conversely an increase of 20% of taxi movements, a 15% increase in bus and coach journeys, while pedal and motorcycle traffic have increased by respectively 30% and 20%. Based on the success in London, congestion charging programs will be extended in the near future to other British cities.
The two examples illustrate how local transportation policy initiatives foster the deployment of successful ITS technologies with very important positive results in road safety and congestion.

ITS deployment and transportation policies

We now review ITS deployments in Japan and in the USA.

Japan

ITS is often not presented within a transportation policy framework. The ITS technologies are more basically part of the national industrial policies that target products and services to strengthen the national economy. By analyzing the terms (words and concepts) of the front page of the "ITS handbook in Japan" which represents the annual vision of Japanese Government, we can highlight, Table 1, the temporal changes in the attitude (supposedly explained by the choice of terms characterizing ITS at a given time) of MLIT (Ministry of Land, Infrastructure and Transport, Japan) toward ITS. The table shows the change in attitude toward ITS. We mean the changes in motivations and objectives for ITS projects and their deployment plan to which MLIT may pay more attention. The weight (measured by the percentage of occurrence of words characterizing ITS) given to different if no conflicting ITS approaches is changing over time.

Table 1 Number of words used for explanation of ITS projects in Japan and the related keywords (1997, 1998, 2000, 2001, 2002, 2003)

	Yr. 1997 – 1998	Yr. 1998 – 1999	Yr. 2000 – 2001
Total Number of Words in Preface	326 (100%)	301 (100%)	519 (100%)
Number of words included in explanation of VICS	**38 (11.7%)**	14 (4.7%)	28 (5.4%)
Number of words included in explanation of ETC	28 (8.6%)	12 (4.0%)	64 (12.3%)
Number of words included in explanation of AHS (Smart Cruise)	17 (5.2%)	18 (6.0%)	**99 (19.1%)**
Number of word included in explanation of DSRC	0 (0%)	0 (0%)	0 (0%)
Number of "accident(s)"	0	1	1
Number of "safety"	1	1	2
Number of "congestion"	0	1	1
Number of "mobility"	0	0	2
Number of "comfort"	1	1	0
Number of "environment"	1	1	0
Other Key Word(s)	information & telecommunication technology, compatibility of systems, international standardization of ITS, ISO/TC 204, common global system	social and economic activity, effective and efficient ITS, multifaceted ITS application, cooperation both nationally and internationally, world-wide cooperation and partnership	killed, injured, time loss, economic loss, aging society, elderly*4, vibrant society, IT, revolutionize industry and society, high-quality social service, IT revolution, enrich people's life, real-time information, variety of users' needs

(2001, 2002, 2003)

	Yr. 2001 – 2002	Yr. 2002 – 2003	Yr. 2003 – 2004
Total Number of Words in Preface	527 (100%)	517 (100%)	562 (100%)
Number of words included in explanation of VICS	34 (6.5%)	34 (6.6%)	34 (6.0%)
Number of words included in explanation of ETC	65 (12.3%)	**90 (17.4%)**	**135 (24.0%)**
Number of words included in explanation of AHS (Smart Cruise)	**88 (16.7%)**	62 (12.0%)	**0 (0%)**
Number of word included in explanation of DSRC	0 (0%)	0 (0%)	**66 (11.7%)**
Number of "accident(s)"	1	1	1
Number of "safety"	2	2	2
Number of "congestion"	1	1	2
Number of "mobility"	2	2	1
Number of "Comfort"	0	0	0
Number of "environment"	0	0	1
Other Key Word(s)	killed, injured, time loss, aged society, elderly*3, vibrant society, IT, revolutionize industry and society, high-quality social service, IT revolution, enrich people's life, real-time information, open platform, variety of users' needs	killed, injured, time loss, aged society, elderly*3, vibrant society, IT, revolutionize industry and society, high-quality social service, IT revolution, enrich people's life, real-time information, open platform, variety of users' needs	killed, injured, time loss, aged society, elderly*3, vibrant society, IT, revolutionize industry and society, high-quality social service, IT revolution, enrich people's life, variable and flexible toll price, raising the efficiency, smooth transport, diverse public and private services, variety of users' needs

The features including some major changes observed in these tables are as follows.

1) The preface of ITS handbook before 1999 includes the less explanation of ITS, such as Vehicle Information Communication System (VICS), Electronic Toll Collection (ETC), Automated Highway System (AHS) and so on, compared with the preface of handbook on and after 2000. Instead of the explanation of these systems, the preface tends to include much explanation about the organizational aspects to develop and deploy ITS in Japan.
2) The percentage of explanation about VICS seems to be stable especially on and after 2000, since the initial deployment of VICS in almost all the metropolitan areas was done by the end of 2000, and VICS continues to provide drivers with real-time information stably.
3) There are two big changes in around 2002: a) decrease in explanation of AHS (or Smart Cruise) and b) increase in explanation of ETC together with an appearance of Dedicated Short Range Communication (DSCR), which is one of the key technologies to deploy ETC. The decrease in explanation of AHS seems to be rather drastic and no explanation can be found in 2003, due to the difficulty of nationwide deployment of AHS in a short term.

The trend illustrates how the ITS policies in Japan reflect the industrial development. The emphasis over time from VICS to AHS, then ETC and DSCR gives the tempo of the industry priorities in the country.

United States

More than 50% of the ITS federal budget, Table 2, is dedicated to ear marked (Pork barrel[1]) ITS projects. This is a natural trend in transportation spending in the U.S. federal budget as shown by Utt (1999), Figure 5. The ITS deployments are not necessary part of a global transportation policy; they are more usually linked to the political power of local congressmen eager to attract federal funds for ITS deployments in their jurisdiction.

Table 2 U.S. federal 2003 ITS budget

Research and development	$52,000,000
Operational tests	$12,000,000
Evaluations	$ 7,000,000
Standards and architecture	$18,000,000
Integration	$11,500,000
Program support	$11,500,000
Sub total	$110,000,000
« ITS Deployment Incentive Program » (in fact Pork-Barrel)	**$122,000,000**
Total	$232,000,000

[1] **"Pork barrel"** implies special projects for the US Members of Congress to distribute to their constituents as an act of largesse, courtesy of the federal tax payments. see: http://www.c span.org/guide/congress/glossary/porkbarr.htm

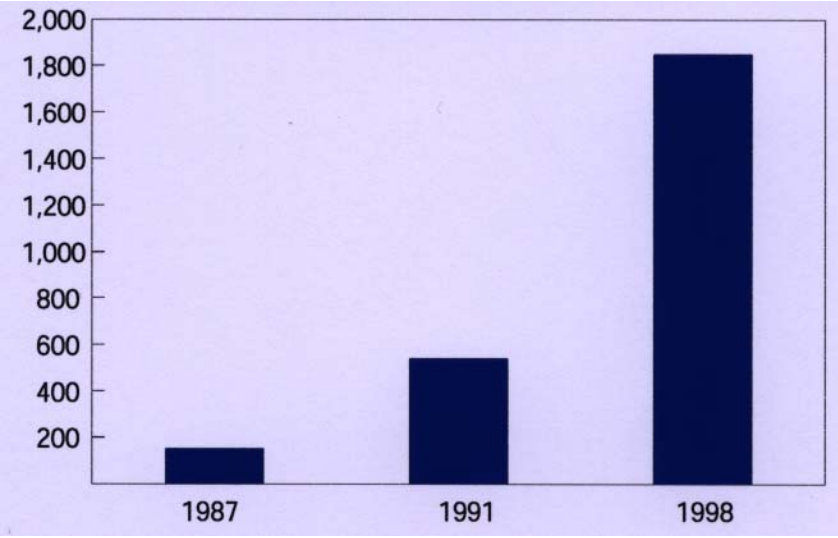

Figure 5 Number of earmarks in highway authorization bills, 1987-1998, source[2]:

The ITS investments may target local safety, or congestion issues but the multiplicity of local decision players around the country limits the strength of a long term national ITS implementation policy. Many evaluations have shown a high benefit-cost ratio of local ITS deployments (incident management systems, traffic management centers, etc.), but unless these high tech elements are deployed in an integrated, coordinated, cooperative manner these ratios are not likely to be realized on a larger scale.

Closure

Clearly, ITS has the potential to play an important role in addressing the long-term transportation problems as demonstrated by the two recent examples. However, ITS role can be enhanced by intertwining it with conventional policies that are known to be effective, e.g., enforcement or congestion pricing. ITS must recognize and internalize the fact that transportation system depends on spatial, social and economic systems. Inertia in these systems implies that ITS technologies must account for the on-going planning and operations processes. Applying information and communications technology to transportation systems is not a purely technical issue and we must account for the non-technical and social aspects. In practice the technologies involved in ITS must be explained, demonstrated to a much larger community than it is today. Policy makers, urban planners, architects and many more who have a role in the future of transportation and changes in mobility patterns are not usually aware of the existence and possibilities of ITS.

ITS has been largely driven by the industry and public agencies, both of whom have focused on attempting to prove that it is successful in all cases. So we do not have a process similar to the health field for evaluating promising drugs/countermeasures.

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[2] "Statement by Senator Connie Mack on McCain Amendment Dealing with Demonstration Projects," March 11, 1998; Report 105-550, Transportation Equity Act for the 21st Century, Conference Report to Accompany H.R 2400, 105th Cong., 2nd Sess., May 22, 1998.

It is true and important to point out that the ITS challenges are also market driven. But the slow development of this market confirms that ITS is far from following the economic growth of many consumer products. ITS is considering at the same time customers but also citizens and tax payers who have something to say about the public spending for the transportation infrastructure.

In less than ten years, Sony has sold more than 100 millions play stations around the world. Hundreds of millions cell phones are used daily, and the top ITS selling product remain with only 10 millions navigation devices in Japan after more than 15 years of solid investments. Nevertheless, a few hundred speed radar detectors could save thousand lives. ITS deployment remains a paradox between the national economical needs for developing a large ITS consumer market and the importance of social benefits which are not necessarily related to the size of this market.

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