Institutional challenges to ITS deployment and adoption

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1 Abstract

The technological breakthroughs and potential road safety benefits of Intelligent Transport Systems (ITS) have been widely acknowledged by road safety stakeholders. Unfortunately, road safety stakeholders are much more cut off from another, within their separate systems and modes, than in the case of telecommunications or computer technology. A gap still exists between the world of transport and that of new technologies, which is due, to a certain extent, to issues related to infrastructure, regulations or institutions. We argue that states and territories can provide a vital driving force for the establishment of ITS services if a clear strategy articulated with private and academic sectors' demand is defined. There is a need to understand and target specific needs and solutions at a regional or community level. This could be achieved by involving road safety stakeholders in charting practical ITS programs or activities for a targeted community. Activities could range from an awareness program such as a showcase of available ITS to educate local policy-makers and general public; to an ITS deployment program. A focused approach will help to make a better case for promoting the role and benefits of ITS in road safety. We also argue that the introduction of new technologies opens up new issues and requires public authorities to re-think the "rules of the game". For example, liability is an issue that private or academic sectors could not address without the involvement of policy makers. This requires a coordination not only at national level but also at international level where significant advances have been made.

2 Introduction

Road users can be made aware of crash risks such as inappropriate speeds through education, driver training, Intelligent Transport Systems (ITS) or publicity campaigns. Large amounts of funding are expended by governments on publicity campaigns aimed at improving road user behaviour. There is a significant amount of evidence showing that publicity is effective in reducing deliberate law violations such as speeding when it is articulated with rigorous enforcement and change of law. France adopted such an approach towards speeding. In France two in every three drivers report that they exceed the speed limit regularly. Three drivers in every five do not respect the road rules in cities. Three drivers in every five drive too fast on all roads and one in two drives too fast on highways. Speed also contributes to 62 % of crashes on curves. Canel and Louvier (2004) summarises the French ITS intervention related to speed as follows:

"*On the 14th of July 2002, the national holiday in France, the French President Jacques Chirac announced that the 'fight against road unsafety' would be one of his three main objectives for the next 5 years. A year later, in summer 2003 a road safety action plan was adopted. One of the most important actions concerns the introduction of an automatic enforcement and penalty system for speed violations. In November 2003, the first speed cameras were installed. At the end of 2004 there were 400 speed cameras (232 fixed and 168 mobile) and it is expected that by the end of 2005, there will be 1000 systems in function (700 fixed and 300 mobile). Unlike other countries, every box will hold a camera. Sites are clearly signed and publicised. Revenue can be used for other road safety operations. In the first full year of operation (2004), two million speeding violations were recorded.*"

Speed camera deployment is an important public policy, engineering, and traffic safety intervention for France. Public policy refers to a set of interrelated decisions taken by a

group, be it political or not concerning the selection of goals and actions to achieve it. It does not necessarily mean government actions. The quotation above shows that the French successfully managed to articulate and intensify the enforcement aspect of speeding through media campaigns, policy and engineering. The results were extremely positive. In 2003, the French road toll was reduced by 20.9%.

ITS is an important part of 21st century transportation. It has been estimated that ITS has the potential to reduce fatalities and injuries by 40% across the OECD, saving over USD$270 billion per year (WHO, 2004). ITS integration into the transportation mainstream faces many challenges, some technical and others institutional in nature. Australia's market penetration of ITS is slightly slow compared to the US, Europe and Japan's adoption. Therefore, Australians are still far from appreciating the full benefits of ITS.

The key barriers to the visionary future of ITS are principally institutional and financial. However, social relevance and utility of ITS research are also key to its adoption and deployment. It requires a concerted effort at all levels of our social and economical structure. Most research in ITS has focused on technology, Human Computer Interface and safety benefits. However there are no clear concepts addressing the question of how different road safety stakeholders in public and private sectors should interact and be governed to advance ITS adoption. This is a research topic in itself and has been neglected worldwide and in Australia (GARIG, 2005).

Section 3 presents existing barriers preventing adoption of ITS. Section 4 presents a systemic approach towards understanding complex interactions between road safety stakeholders. Section 5 presents recommendations on future strategies to increase the pace of ITS adoption. Section 6 concludes this paper.

3 Barriers slowing down ITS deployment

Despite the potential benefits of ITS, there are still many barriers preventing its deployment.

3.1 Absence of real partnership between road safety stakeholders

We categorises the major forces playing a role in road safety into 3 categories:

- Government: Government ensures the safety of ITS systems used by the public. Government policy can accelerate or moderate the pace of ITS uptake. It can remove regulatory barriers or give incentives for early adoption. For example the government will have a major role to play in the introduction of roadside-to-vehicle or vehicle-to-vehicle communication technology as it involves public infrastructure, privacy issues and telecommunication regulations. There is also a lack of partnership between Australian state and federal government. Most of the road safety initiatives are lead by state governments which makes a coordinated nationwide ITS intervention difficult to implement.
- Nongovernment entities such as insurance companies responsible for programs such as the Australian New Car Assessment Program (ANCAP) indirectly influence ITS take up. For example the number of vehicle purchases featuring ITS safety features such as ESC (Electronic Stability Control) could be increased by providing clear and consistent information on safety features (ANCAP) or by floating the premiums according to safety features (Insurers). The public, grouped as communities, are another major road safety stakeholder with significant power in voicing concerns either through the media, local political channels (e.g, MPs), or advocacy groups.
- Academics and researchers have the role of providing government policy makers with information on the degree of benefit society can gain from systems ,but also researching needs informed by government priorities.

Each stakeholder tends to operate independently and to our knowledge, there is no clear framework or guidelines showing how stakeholders should interact and what their respective roles are in such interactions. For example, despite a well argued case from the government for a particular intervention (e.g speed cameras), there is often public scepticism about the legitimacy of interventions. Different groups could play a role in highlighting the benefits of an intervention or put pressure on governments to avoid rigorous enforcement.

There is a need to increase, coordinate and harmonise interactions across road safety stakeholders. Such an approach will help policy makers to be more aware of the need and impact of ITS on our society. A wide range of analyses on the societal impacts of ITS have been conducted overseas by European projects such as ADASE2 or CARTALK. One of the recommendation of ADASE2, which is applicable to Australia is to establish ITS champions at a national level to help road safety stakeholders (government, industry communities) to co-operate and have a coordinated vision of what is expected from ITS.

3.2 Silos of services

There is a wide range of technology and services which have the potential to improve road safety (Bishop, 2005). Technology offers services to consumer. For example traffic information could be gathered via video cameras and be offered as free or paid services to consumers through media (e.g. radio broadcast) or in-vehicle traffic management.

Unfortunately most of these services are developed independently. The services cannot interoperate and the data that they use cannot be re-used for different purposes. Such an independent approach does not fit with the concrete demands of road users in terms of a multi-modal mobility pattern. For example, in order to estimate a travel time a taxi user may want to use data about traffic congestion together with information about the whereabouts and availability of a taxi. Such information is not integrated yet.

Generally speaking, there are no large scale ITS products or services that cover the broad needs of road users in the same way Microsoft Office 2000 covers most of the needs of computer users. ITS needs to work like a coordinated suite of programs that talk within one another. The next generation of ITS services should have a more open and integrative approach and provide interfaces allowing access and composition of their services for different applications. ITS should use standard communication protocols and agreed upon methods of implementation so as to work cooperatively. Manufacturing such composable and generic services cannot be done without clear partnerships between stakeholders such as vehicle manufacturers, fleet managers, policy makers, governments, researchers, insurers, media, local community, advocacy groups, telecoms, ITS manufacturers, police, and law as defined in section 3.1.

3.3 Diversity of expertise

One of the aims of ITS is to improve road safety. The common perception of transport researchers and practitioners is that ITS does not improve road safety. In-vehicle technology such as GPS navigation systems are among the ITS technology which have bad press due to their potential to induce distraction. One may argue that in-vehicle technology has improved mobility at the expense of safety (e.g. Variable Message Signs, GPS navigation, traffic management). Motorcyclists are another group of stakeholders which are reluctant to adopt any ITS systems. These examples show that road safety requires strong interdisciplinary partnership. The success of road safety actions is increasingly dependent on government, industries, communities and universities. Partnering road safety stakeholders with different disciplines, backgrounds, agendas and business culture is a

challenging endeavour. It is not always easy to “reach out” to other stakeholders, however such interactions are crucial due to the complex nature of road safety.

Future ITS products will rely heavily on public telecommunication and information technology infrastructure. ITS research has been dominated by technologists in recent years. This accentuates the communication gap between stakeholders. For example policy makers are not necessarily fluent with the “language” used by technologists. Telecom and transport industries are the typical example of road safety stakeholders who need to collaborate but have completely different business cultures. We are starting to witness emerging partnerships such as GM (General Motors) and IBM and Telecom companies. Unfortunately these cases remain overseas and isolated.

There has been virtually no research on how to enable institutions, especially university research groups, to conduct multidisciplinary research in general and in road safety. There is a need to examine how institutions move from a mono-culture and mono-disciplinary perspective that supports a specific agenda to those that are supported globally by a multitude of complex and independent socio-economic road safety stakeholders. GARIG (INRETS) has initiated research in this area. GARIG aims at developing a conceptual framework which will help to understand the complexity of social systems involved in the production of road safety knowledge with the view to guide strategic plan for stakeholders involved in it.

4 Inadequacy of existing choices

This section shows few examples of road safety interventions that show lack of coordination between road safety stakeholders.

Although urban planning increases attention to design friendly to vulnerable road users, road transport policy developments tend to focus on facilitating motorised traffic. For example ITS developments for cyclists, pedestrians or even motorcycles are very modest compared to other vehicles. Privileging a category of road user at the expense of other groups as a minority could be seen as a sensible democratic exercise. However road crashes do not reflect the adequacy of such a choice as road safety is not about majority or average. Most road users behave safely and only a small proportion contribute to crash statistics. Road safety is about exceptions caused in exceptional circumstances.

In the past, ITS developments were lead by private industries, driven by economic growth, which was attained by facilitating market participants, without governmental guidance or participation. In-vehicle GPS navigation systems or use of mobile phones are typical examples. These often result in unsafe driving behaviour, some inadequacy between real needs and offers and scepticism from the public or road authorities.

It has been shown that drivers using Intelligent Speed Adaptation (ISA) drives slower that driver not equipped with ISA (EU Prosper project, 2005). Driving simulator studies of the use of ITS have shown that they have a positive effect on safety and also lead to a reduction in fuel consumption (Carsten and Fowlkes, 2005). It does not have known negative effects (Bidding and Ling, 2002). A driver acceptance survey showed that drivers find ISA very useful (SARTRE, 2004). Another survey among road safety stakeholders such as politicians, governmental institutes, research institutes, community and commercial groups show that ISA is seen as an effective measure. The same convincing safety features have been conducted for ESC (Electronic Stability Control). However the market penetration of ESC is still very low by European standards and vehicle manufacturers are still slow in equipping their new vehicles with ISA.

5 Model

A systemic thinking has become the norm for motorised traffic. The past reactive approaches which consist of solving emerging safety problems are long gone. Nowadays, proactive and visionary plan such as Vision Zero are very popular. However the knowledge to operate in a system of thinking is still fragmented or incomplete and there is a need to have a comprehensive reasoning framework and forecasting mechanism in order to assess whether users are likely to adopt a technology. Some of these technologies don't exist yet.

The interactions between road safety stakeholders are complex. However we propose a conceptual framework to reason about different interactions of stakeholders. The model evolves around crash and injury risks. Figure 1 shows three stakeholders represented in boxes namely public/private research, community and institutions collaborating to identify and reduce road risks. All stakeholders try to identify, reduce and predict risks. This model embraces the idea that that those in the wider community such as advocacy groups are new players which needs to be involved as a democratic requirement. It also shows that researchers need to be aware and respond to research or consultancy issues from policy makers. The three players need to work together to have a clear pictures of risks and weight the consequences of interventions. The arrows represent the flow of information between the stakeholders

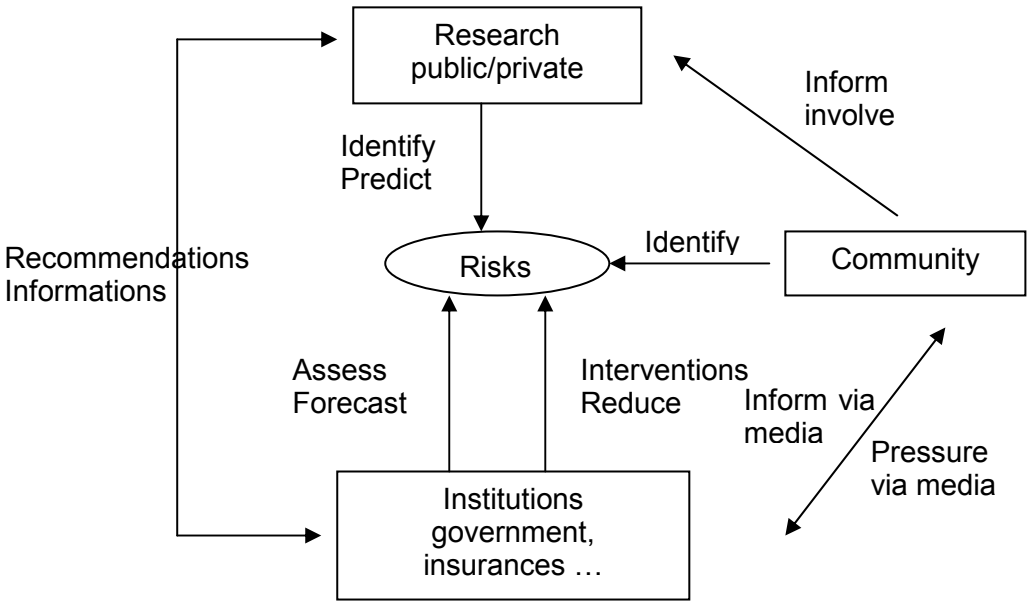

Figure 1: Interactions between road safety stakeholders

6 Where from here?

Most of the road safety investments are dedicated to reduce the fatal four namely speeding, drink driving, not wearing a seat belt and driving while fatigued. Devices such as alcohol interlocks, speed cameras, seat belt warning systems and lane departure detection systems are among ITS technology interventions which have not had the expected market penetration given the significance of the problem. Unless ITS becomes integrated into system planning by demonstrating an ability to improve road safety and mobility, it risks being confined to "gadgets with potential".

6.1 Inform decision makers and public about the benefits of ITS

ITS must address the need of local communities so that local governments and communities feel ownership. These require extensive complex interactions such as consultancy and evaluation among local communities, governments etc. This is easier said than done as progressing work within government institutions need a deep knowledge of institutional characteristics such as hierarchy, administration, politics. Furthermore if government action is expected then a real sociology of public action needs to be understood before any implementation.

6.2 Technological solutions covering multiple applications

There is a strong need to provide ITS solutions that can address many applications in order to maximise each investment. Sharing knowledge and databases is crucial to achieve such an application however database sharing is a real bottleneck in collaboration. Overcoming such a hurdle requires the elimination of formal and informal boundaries between institutions. These boundaries can be related to intellectual property, ethics or simply an inability to access internal information.

6.3 Media campaign articulated with strong public policy

Road safety communication aims at reducing road risks. Mentalities need to be changed to change behaviour. In France, a new communication strategy is defined each year. At least 5 campaigns are launched nationally on themes related to priorities informed by trends in crash data (with a budget of 10 millions of Euro in 2006). As an example, total fatalities have been reduced by 8.7% but motorcycle fatalities increased by 0.1%. This lead the government to prioritise motorcycle safety.

All public campaigns are evaluated (pre/post). Each message needs to be renewed, adapted and more specific. The effectiveness of messages is measured by impact, perception and recall. The government has official means to follow opinions poll. The French target the most resistant group of people by showing scientific reason to debunk the wrong “good reasons to speed”, not by trying to be bluntly violent.

Targeted communication requires proximity cooperation involving associations, mayors, insurance, manufacturers, fleets, school, religious groups, driver trainers and government departments. The idea is to “touch” the road user at anytime of social life; not only as an individual but as a member of community and social infrastructure. For example, an SMS message could be use to target young drivers and campaign against their risky behaviour.

7 Conclusion

Australia still has a small ITS market. The average age of the vehicle fleet in Australia is 11 years, compared to 3 years in Japan. This is an impediment for in-vehicle technology adoption as it would take a minimum of 11 years to fit most of Australian’s fleet with ITS in-vehicle technology. Retrofitting existing vehicles with new technology is a possible solution but provides poor ergonomics.

Road safety stakeholders have the same goal which is to improve road safety. Therefore they need to share the responsibilities for implementing and finding new opportunities. Road safety is a very practical multi-disciplinary activity involving many disciplines. Progressing road safety is a complex issue. Researchers need practical questions to orient the research. The University should place a high priority on the relevance of its research to industry and government needs. Technologists lack real social questions as they often take the approach of what can be built as opposed to how to solve a societal problem. Non research

institutions are not well aware of the latest research. Policy makers are perceived as out of sync with communities. The lack of communications between stakeholders is not unique to road safety. The complexity of problems and the involvement of different disciplines exacerbate the problem.

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