DHV INTEGRAL APPROACH TO INTELLIGENT TRANSPORT SYSTEMS

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SUMMARY

Intelligent Transport Systems and Services (ITS) has the potential to increase safety, reduce congestion, reduce environmental impacts and create new business. A growing number of ITS applications are spreading throughout the world. The high investments commonly involved in the deployment of such systems, require a maximum benefit of their capabilities and a fully integrated perspective.

This paper presents the integral approach developed by DHV for the implementation of Intelligent Transport Services & Systems from policy development to practical implementation and operation. The approach is based on three essential focus points: the development of **Policy** and strategies for ITS; the **Organisational** transition and adaptation to the implementation and operation of ITS; and **Systems** implementation and **Services** delivery.

1. INTRODUCTION

1.1 ITS promotes efficient, safe and economical mobility

With the steady population grow, the mobility management presents an increasingly difficult challenge. Public authorities and private entities alike seek new intelligent solutions to the problems faced in today's Mobility and Transport Networks. Intelligent Transport Systems and Services (ITS) describe any system or service that supports the movement of people or goods more efficiently, safely and economically, using Information and Communication Technologies (ICT), thus more "intelligent".

1.2 Through Technology Push: partial and costly ITS solutions

Experiences from the past on ITS deployment show us solutions driven by a technology push. Individual local system(s) solutions were implemented for local problems without a consistent network strategy or long term overview. The risk of incompatible individual systems is high, and the ability for extension or modification of the requirements is minimized. In the long run the operational and maintenance of the individual systems, becomes costly, moreover almost impossible to adapt when technologies vary. Thus, only a partial and long term expensive sub-optimal solution is achieved.

1.3 Technology advances increase both expectations and complexity

As ICT technology continues to advance and develop, the systems where ITS is build up becomes increasingly complex. In addition the expectations of stakeholders (and users) are increasing, particularly in terms of system functionality, reliability and the perceived ease with which changes can be incorporated once the system is in operation. However, because systems are now more complex, and require the integration of many components, it is proving to be very difficult to implement stakeholders "wishes" with high levels of efficiency or success.

1.4 Need for integral approach from policy to implementation

An integrated and sustainable system should provide greater benefits than when the components are individually implemented. In order to achieve such integration it is often necessary to have companies and public authorities co-operating to achieve both their commercial and public service aims respectively. It is also necessary for the various engineering disciplines and manufacturers to work in harmony to create the integrated ITS. Dealing with these issues requires a structured approach that oversees ITS implementation from policy development to practical implementation and sustainable operation. DHV integral approach is based on three essential focus points: the development of **Policy** and strategies for ITS; the **Organisational** transition and adaptation to ITS systems and services; and sustainable **Systems** design and implementation process.

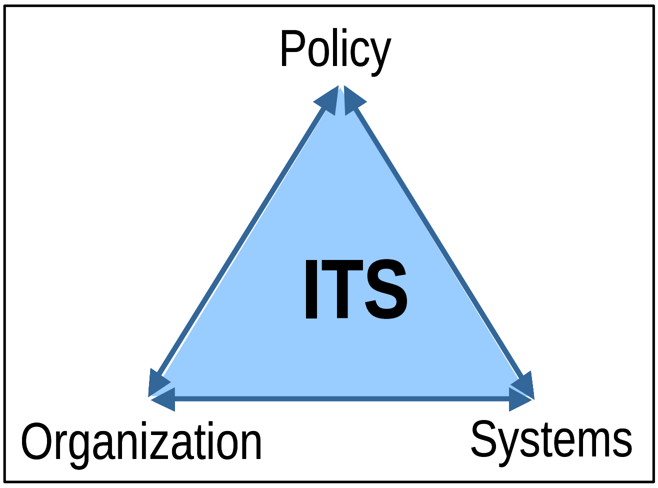

Figure 2 – ITS DHV integral approach

2. FROM POLICY TO ITS SERVICES

2.1 ITS is an instrument to achieve Policy goals

ITS is used to address a wide range of policy objectives including enhanced safety, improved accessibility to services and reduced environmental impact of transport. They have the potential to deliver significant benefits with respect to operational efficiency, service reliability, infrastructure management and provide valuable information services for transport users:

- **Society**: improvement of the utilization of the existing infrastructure, improved circulation, safer, less environmental pollution;
- **Business**: better use of capital of a company (fleet, roads, information), improvement of internal processes, better costumer service;
- **Individual**: more comfort, safer, flexible mobility, less travel time.

2.2 From Policy development to ITS services

Policy statements are widely recognized in the Transportation world. But their identification, establishment and concretisation requires a comprehensive process involving the following stages:

- Involvement of all relevant Stakeholders
- Identification of Stakeholders needs, “wishes”, concerns and priorities
- Translate needs and “wishes” into Policy statements (establishment of goals)
- Policy statements translated into Strategies and performance requirements

- Identification of ITS services complying with Performance requirements
- Selection of "optimal" solutions
- Implementation of End User oriented ITS services

2.3 Advantages of an Integral approach:

- Provides common understanding and assumptions between Stakeholders
- Permits economies of scale by implementing ITS solutions addressing different stakeholders needs
- Top down justification for solutions based on identified needs and aspirations, and independently from given technologies
- Ability to monitor performances of ITS based on pre-established goals and improve or enhance measures.

European Commissions' Policy for Road Safety

The White Paper "European transport policy for 2010: time to decide" identifies "Improvement of Road Safety" as policy guideline. The measurable goal associated to this policy is defined as: "Halving the number of deaths in the Euroepan Union until 2010". As one of the Strategies for achieving this goal the Commission commits to the "Promotion of new technologies" by sponsoring programs to the development and implementation of "vehicle speed management" by national and local authorities.

Ring road of the city of Utrecht (The Netherlands)

The responsibility for the Road network in the Utrecht region is shared between the Ministry for Transport, Public works and Water management; the Province of Utrecht and the Municipality of Utrecht. Utrecht Ring is an important node at national and European level, all parties are responsible for sections of the ring road and need to find a solution for the congestion on the ring road. It was recognised that a common approach would be most feasible and effective to solve the traffic problem. In both cases a top-down approach was used, intended to solve the problem at the operational level i.e. on the street. The cooperation turned out to be very effective, a step-by-step approach allowed for a visible and understandable process for all involved road administrations. The first step was to define a common vision, the second step was to translate this into a common network strategy and network requirements and the third step was to determine the operational measures.

3. ORGANISATIONAL ASPECTS IMPLEMENTING ITS

3.1 Functional and resource needs by implementing ITS

The implementation of ITS requires a number of supporting *functions* (processes and operations) in order to perform such as: control centres operations, data process, information delivery, customer care, equipment maintenance, product development, etc. For each function a set of roles and responsibilities are defined and applied, with *suppliers* and *clients* for each function. Associated to these functions are costs of implementation (facilities, equipment, training, etc.) and operation (maintenance, life cycle costs, development, etc.).

3.2 Prior definition of roles for a shared responsibility

Initial identification and definition of the necessary operational and procedural functions and correspondent costs and benefits. This together with a common vision between all the interested stakeholders, allows for a shared agreement on responsibility, roles and costs according to their core business.

3.3 It's about Services

Organizations assuming responsibilities on implementation and operation of ITS need to engage in a service oriented approach, concentrating on the services being delivered rather than the equipment or infrastructure implemented. In most instances this change of role requires a considerable initial effort within the organisations. But at medium term the service oriented approach assures the deliverance of effective, efficient and safe operational Services to road users.

"Big Shift" CEDR Sub Group Telematics

National Road Administrations (NRAs') are primarily responsible for maintaining and improving traffic flow and safety on their road networks. Traditionally these responsibilities are met through the construction of new roads, widening or improvement of existing roads and through the maintenance of their existing infrastructure. With ITS, new instruments become available to fulfil these responsibilities. As a result the NRAs role is evolving, becoming more complex as the focus is not only on the infrastructure but also on the road user, to include network management and operations. This is the process that has been called the "Big Shift". The Subgroup Telematics of CEDR identified this "Big Shift" and has studied the changes taking place within Western Europe and the USA and has identified the potential benefits and common experiences of the early "shifters".

4. INTELLIGENT TRANSPORT SYSTEMS AND SERVICES

ITS covers a broad range of Systems and Services that has been under development in the past 20 years. These systems have been implemented at various levels around the world, and differences still persist in the coverage and use, even between the most advanced countries in ITS. For example in the past 10 years the navigation systems have become very popular and widely used in Japan, whereas in the US and Europe navigation systems are now becoming more common. A mutual understanding nowadays is that the implementation of **ITS Systems** (equipment and infrastructures) needs to be planned with a focus on the deployment of **ITS Services**.

4.1 ITS Systems and Services in the Trans European Road Network.

The European Commission TEMPO Programme – for Trans European Intelligent Transport systems Projects - is an example of the "Systems to Services" approach. TEMPO is structured by Application domains in a logical operational sequence (Figure 2). **Road Monitoring Infrastructure** within the Trans European Road Network collects "high quality" traffic data. The Traffic Centres spread out through Europe, assemble the collected data and process it into information to be disseminated or to be shared within the **European Network of Traffic Centres**. This information is used by a wide spread of Road Authorities for implementing **Traffic Management and Control** measures (re-routing strategies, tunnel and bridge operations, etc.).

The deployment and performance of the above described domains *serve* a group of pan-European services for private and business travellers identified by the Commission as key European **ITS Services**, which are:

- Traveller information services, specifically: Multi-modal trip planning and Real-time traveller information
- Emergency Handling
- Electronic Fee Collection
- Public Transport Payment and Ticketing

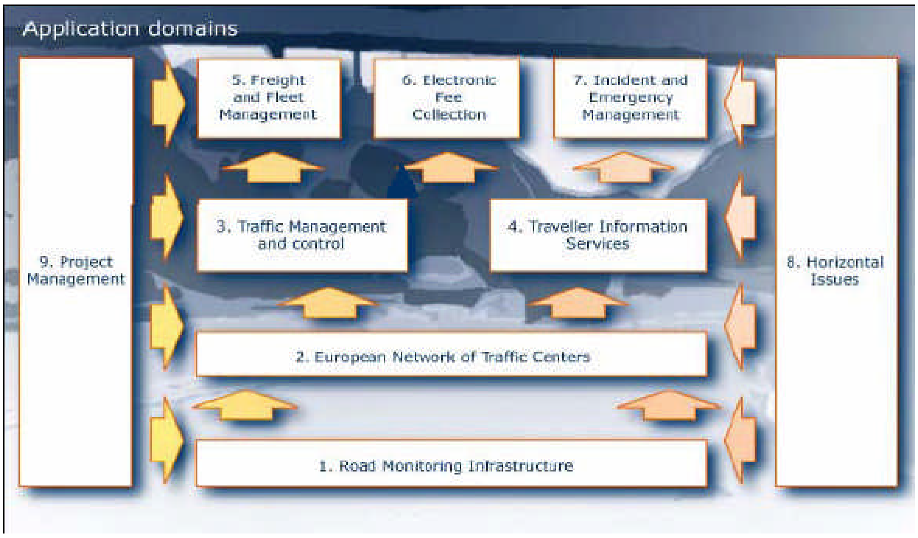

Figure 2 – ITS structure European Commisions' TEMPO Programme

This simplified structure allows a clear insight of process flow associated to the provision of ITS services to it's end users. One can also recognize the need for an **interoperability** of all the domains and intervening elements. Not only between the *technical systems* but also by involved *organizations* and identified (common) *goals*. Public and private organizations in different countries and environments adopt their own structure, tailor made to their specific requirements, procedures and stakeholders (see chapters 2 and 3 from this paper).

4.2 Fundamental ITS Systems

Essentially one can identify the group of ***Roadway systems, Central management systems and Travelling Information dissemination services.***

4.2.1 Roadway Systems

This group includes both road detection and actuation systems. These systems are related to the equipment placed on and along the roadway, which monitors and controls traffic. Equipment includes:

- vehicle detectors (loops),
- CCTV cameras,
- cellular call boxes (floating car, GSM),
- communication equipment,
- variable message signs,
- video image processing systems
- traffic signals, and
- ramp metering systems.

The strength of ITS services is greatly defined by the *quality* and *availability* of Traffic data. The degree of these requirements is to be balanced by the expected objectives to be achieved, and the capacity for managing (handling) the equipment outputs.

Besides the monitoring and control functions the equipment has local process of data ability ("intelligence"). This feature allows local quick reaction and actuation when centralized network strategy is not required.

4.2.2 Central management systems

Main ITS functionalities are generally centralized in Traffic Centres for a comprehensive and integrated management of applications. The concentration of these systems allows the participation of different stakeholders in the running of operations as well large scale savings of costs. Common Central management systems that one can find are:

Data process and traffic estimation: collects, archives, manages, and distributes data generated from ITS sources for use in traffic and transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The data allows the estimation of traffic situations based on historical data and "near" real time information on intended roads (routes). Traffic estimation serve as input for Traffic Control and Management for decision making on control optimization and strategy implementation.

Traffic Control and Management: communicates with Roadway Systems to monitor and manage traffic flow. Incidents are detected and verified, response plans are implemented, and incident information is provided to an Emergency Management System, travellers (through Variable Message Signs, Radio and other Dissemination systems), and to third party providers. It supports road weather information systems which utilize input from road surface sensors and / or weather forecast information.

Information Service Management: collects, processes, stores, and disseminates transportation information to system operators and the travelling public. The subsystem can play several different roles in an integrated ITS first role, it provides a general data warehousing function, collecting information from transportation system operators and redistributing this information to other system operators in the region and other Traffic Centres. The second role is focused on delivery of traveller information to subscribers and the public at large. Information provided includes basic advisories, real time traffic condition and multi-modal schedule information, yellow pages information, parking information and weather information.

Emergency Management Systems (EMS): emergency centres supporting public safety including police and fire stations, and road rescue teams. This system interfaces with other

EMSs' to support co-ordinated emergency response involving multiple agencies, using emergency response plans to facilitate co-ordinated response. The Subsystem supports disaster response through an interface with the Disaster Command Authority Terminator to co-ordinate disaster response activities and status.

Other central functionalities can include: **Environmental management, Fleet and Freight management, Transportation (multimodal) management, Maintenance and Toll management**.

4.2.3 Travelling Information dissemination services

The effectiveness of ITS is strongly related to the success of the information distribution to the required users. The distribution of travel information influences the travellers' behaviour giving them the decision making ability for improvement of their trip plan based on their travel requirements via optimal departure time, arrival time predictability, best mode choice, reduce congestion related stress, etc.

Transport Authorities are willing to implement ITS systems for the provision of *real time pre-trip* and *on-trip information services*, for the improvement of road safety and for the reduction of congestion levels. To this purpose several multimedia channels are used to maximize information dissemination:
Mass-media: TV, TeleTex, Internet, Radio, Kiosks, RDS-TMC,
Personalized: Internet, Call center; Mobile (SMS), GPS Navigation System

The operation of such multimedia channels are currently not part of the core business of National Road Authorities, Public Transport operators or other transport organizations (public or private). Therefore new stakeholders come in scene such as Service providers and Telecom Operators. Again the choices on the division of tasks, responsibilities and competences; organizational agreements; division of costs and risks comes again under discussion, depending mostly on the vision of Public Authorities and the objectives to be achieved.

5. REFERENCES

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