D2 ITS Deployment Drivers

Incentives and other mechanisms supporting ITS deployment on transport corridors

A report from EU EIP Activity 4.3 European ITS Deployment Road map

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2. Preface

The overall objective of EU EIP sub-activity 4.3 is to support the alignment of national, regional and CEF corridor ITS deployment plans to achieve higher efficiency in ITS deployment and more impact from the use of ITS.

As previously concluded (e.g. EU ITS Action Plan[1]) ITS deployment is fragmented and not taking place with the appropriate speed, and it is difficult to reach the level of interoperability and synchronization required to release the full potential in ITS.

The aim of this report is to identify drivers behind ITS deployment and assess their potential impact in terms of speeding up deployment and harmonizing systems and services. The report has been developed by the EU EIP Sub-activity 4.3 Task Force and include the results from literature studies and two workshops held 2017-2018 together with findings from earlier work on ITS Deployment Road Maps. Important background information has also been found in the 2017 National Reports in response to the ITS Directive and in the Issues Papers published by CEF Corridor Coordinators[2].

A reader might react to the "technical" approach taken to the question of drivers for ITS Deployment. One could argue that "climate change", the goals stemming from the Agenda 2030 agreement and digitalization should be listed as drivers for ITS deployment. Indeed they are, but we have avoided to include such "meta drivers" in our analysis as they will appear in the form of regulations, cost benefit ratios, business opportunities and other drivers which are included.

The work in SA 4.3 has been coordinated by Arne Lindeberg, Trafikverket, Sweden.

[1] COM(2008) 886 final

[2] ISSUES PAPERS OF EUROPEAN COORDINATORS, 2016-05-12

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3. Background and methodology

3.1. Driving forces behind ITS deployment

ITS deployment activities follow in general from five main driving forces. In most cases they act in combinations, and are not easily distinguished from each other:

Perceived transport system needs: Most important are investments that are made in response to specific perceived local needs – solving problems at critical spots; measures to increase safety, reduce environmental impact from local traffic, improve intersection and road section throughput or provide better quality of service to road users.

Transport policies put in place: ITS deployment is also made in response to policies that are not directly related to local needs; e.g. road user charging systems are put in place to drive modal shift on a general basis in support of emission reduction, reduce congestion or simply to collect money to finance investments.

Sometimes policies are expressed as legislation requiring ITS implementation. Such ITS would not have been implemented in the same manner without legislative support. Good examples are the National Access Points now under development, eCall which is compulsory from 2018, the implementation of the Digital tachograph where a new generation is introduced from 2018 and measures in response to the EETS (the EFC Directive).

Technical development: Also, technical development is in itself driving ITS deployment; new ITS are put in place simply because they have been made available, without fulfilling transport system needs or driving policies. In this category, we address in-vehicle safety systems (ADAS), cooperative ITS (C-ITS), automation (e.g. automated driving), infotainment etc.

One can argue that in-vehicle safety systems (ADAS) are implemented in response to policies on safety, we will however select to include them among technology driven ITS.

Organizational development: Digitalization and automation create opportunities for new groups of stakeholders and alliances between stakeholders. New systems and services open up for organizational and technical development. Providers of telecom and AI becomes involved in transport system development as the traditional role of infrastructure providers is changing.

They create business opportunities: Several ITS are deployed on the basis that they generate better business for organizations, public as well as private: More efficient maintenance of roads, better load factor of lorries and passenger cars etc. Fleet management systems, ride-share opportunities etc. are examples hereof.

The strength in these driving forces are different and varies (grows) also over time. Whereas safety related measures have been in focus through history (as well in-vehicle as road side), an increased need for efficient infrastructure use is coming

up as a key driver, supported by digitalization and automation. One important reason for this being that in-vehicle safety is now considered to be quite high. It is also important to recognize that different drivers may be present at different levels: On a national level policy related ITS measures may be in focus, while on the local level (where the real bottlenecks occur) traditional physical measures may be more relevant. Hence a key question concerning driving forces behind ITS deployment is "where is the money?". Is the money available on a higher policy level, or is the budget linked to the physical road network as in traditional infrastructure planning?

3.2. The Work on EU EIP ITS Deployment Road Map

The work in the first two phases, reported in *ITS Vision, a scenario for ITS deployment on European road transport corridors accounting for regional preconditions*, concludes that with the purpose of designing a road map for establishing and operating ITS that aim at optimizing network/corridor performance we can see that three important prerequisites need to be fulfilled:

- There is a need for harmonization (architecture and specifications)
- Drivers, including incentives, will be required
- Stakeholder responsibilities need to be developed

The work in Phase 3, reported in this document, has focused on the second bullet, which will lead on to development of stakeholder responsibilities and actions which will be included in the final report.

As shown in the studies presented in our previous report, road operators primarily focus on solving local needs through local measures. To establish and operate ITS that optimize network/corridor performance, various drivers (including incentives) will be needed to ensure that stakeholders also value the corridor perspective in their investments decisions.

Such drivers may include:

- Incentives like financial support, to projects supporting the development of corridor strategies
- Legal measures supporting and facilitating innovations in investments, but also providing restrictions preventing innovation.
- Knowledge on corridor performance and its impact on local traffic, with particular attention to the impact from freight transport
- New traffic management tools connecting local and corridor perspectives
- Support in planning and design for transport system balancing local and corridor needs
- Stakeholder cooperation for identifying potential benefits from integration of systems and services

The work in Phase 3 has focused on developing ideas and knowledge concerning such drivers. We have also been asked by INEA to pay particular attention to the impact of CEF support in relation to transport corridor development, which points at the first bullet above.

3.3. Methodology

The method applied in the EU EIP ITS Deployment road map sub-activity can be summarized in the following steps:

1. Identify characteristics of a corridor perspective – the target situation.
2. Clarify which systems and services that support this development and how a corridor perspective differ from a local perspective – what is the required add on?
3. Identify and describe drivers that contribute to development and implementation of these systems and services in support of corridor functionality
4. Assess the possible impact of these drivers
5. Identify mechanisms that support the development of this driver
6. Clarify stakeholders responsibilities

The two first steps were reported in the deliverable *ITS Vision, a scenario for ITS deployment on European road transport corridors accounting for regional preconditions*. This report deals with steps 3 and 4, and the concluding two steps will be reported in the final deliverable.

3.3.1. METHODOLOGY APPLIED FOR THIS REPORT

The analysis made and reported in this report is essentially carried out in the following stages:

- Literature studies (all through the process)
- First internal workshop (Frankfurt March 2018)
- Topic paper development
- Second external workshop (Bruxelles May 2018)
- Development of a driver assessment framework
- Sub-Activity Task Force driver assessment (Multi-Criteria Analysis)
- Conclusions and reporting

4. Results from literature studies and other sources

4.1. Findings in 2015 national reports in response to the ITS Directive

In a previous report[3] we have reported on the national ITS deployment plans reported in 2015 in response to the requirement of the ITS Directive[4]. The key conclusions from this study were:

1. National plans are goal oriented

- It is clear from the plans that member states planning are goal oriented. The plans do (in general) not define what services that shall be in focus, but points at the goals and objectives that have been set for ITS deployment.
- The first hand objective stated is to use ITS in order to improve or maintain the flow on the road network. Through this, also goals concerning environmental impact and safety will be met.

2. The needs and plans are country specific

- The plans reflect that the activities planned follow from the particular needs of the different countries and from the current status of ITS deployment. Hence, a "one size fits all" ITS Deployment Roadmap is not in line with the current situation.
- Countries with a lot of through traffic have a clear focus on Heavy Goods Vehicles, including services for to driver and carriage control measures like Weight In Motion. These countries also point at the need for solutions for uniform measuring of carriages (length, width, height etc.).

3. Traffic Centre upgrade is in focus

- Many countries have experienced that new systems and services have been brought into the Traffic Management Centres during the last years without changing the architecture of the systems. This has resulted in a situation where centre operators operate different systems through different interfaces without coordination.
- Many countries now plan to renew their TMC´s to bring order in the operator interfaces and enable interaction between systems (e.g. for data collection)

4. DATEX II is considered as an important tool

[3] ITS on European roads, State of the art description EIP Activity 5 Version: 1.3,: 23 April 2015

[4] Reporting on national ITS actions Referred to in article 17 of directive 2010/40/EU

- It is also clear that there is no alternative to DATEX II in terms of providing a solution for exchange of traffic information. Several countries plan to upgrade or invest in DATEX II during the period.

5. Data supply and quality are important

- Several countries see the need to open databases and release traffic data for third party service providers.
- Besides real time data from the traffic network, also data about the network is requested by service providers and other external actors: Road network data, speed limit information etc. There is an obvious pressure from commercial actors in this area.
- The member states also point at the need to develop knowledge and practises for securing data quality as the need for data grows.

6. ”EasyWay” (ITS Corridors) is key to cross-border cooperation

- Many countries point at the EasyWay community as the primary tool for cross-border cooperation and harmonization. No alternative to EasyWay is discussed

4.2. Update based on 2017 National reports

In 2017 21 EU Member States and Norway have reported plans available to this study. The key questions for our analysis are how different countries motivated their investments in ITS and which priorities they applied. Also the use of incentives and other drivers to boost ITS deployment was searched for.

From our look at the 2017 national reports, some reflections can be pointed at:

1. Specific investments in the network are not included in plans

The national reports do not well describe the specific investments planned and the motivation behind those investments. As an ‘update report’, the investment activities described as updates are not clearly motivated (why they are done) and are also missing in some reports. It makes it quite difficult for an external body to see the motivation behind these investments.

2. KPI’s are there, but are very weak and effects cannot be clearly derived

KPI’s mentioned in the national reports lack a perspective of measurement, mainly due to lack of ex-post evaluation. In most of the plans there were no measurements made before the deployment of ITS activities, which made it difficult to measure the effectiveness of the deployment. Hence providing the KPI’s seem very weak and in some cases quite vague.

3. The plans do not drive deployment, they lack description of incentives

Worth to mention is that the submitted plans are merely update documents and lack information or description on how they drive ITS deployment from a national

perspective. It is hence unclear from the plans what steps the countries are taking to meet the objective in that part of the deployment.

4. The reports do not motivate or argue for plans other than in vague statements

The reports merely touch on the plans and lack the motivations behind the activities pointed out in the plans. As a result, the reports just mention the importance of steps and activities which are beneficial for ITS deployment, but do not talk about steps taken or actions carried out as a result.

To conclude, the 2017 update of the National Reports in response to the ITS directive do not add to our previous analysis of how member states, including other stakeholder, incentivize ITS deployment or report on the driving forces behind ITS deployment in the member states. The concluding observations can be summarized as:

- ITS investments follow from perceived needs, may it be in connection with new infrastructure investments or maintenance of legacy systems.
- Platforms for cooperation are considered as important for cross-fertilization, best practise knowledge etc.
- Harmonization (e.g. DATEX) is good, it facilitates development of Traffic Management Centres which are important

4.3. US DoT Report on ITS Deployment Incentives

US DoT has conducted analysis in 2014 with a scope very similar to the objectives of this report[5]. The purpose of the report is to convey the ways in which the Department has used and will continue to use incentives to promote and accelerate the adoption and deployment of innovative ITS. The key findings are summarized below.

Deployment is found to be more likely to be achieved when a full range of incentives is applied over the course of the ITS Research and Development lifecycle, from planning and demonstration program grants, to Knowledge and Technology Transfer (KTT) activities such as technical assistance, training and guidance. The Integrated Corridor Management (ICM) program is good example of this; the program has accelerated awareness of the ICM concept through a research and demonstration program, outreach and guidance, workshops, training activities, and a recent deployment planning grant program.

Funding is always an important ingredient to address. **Increasing the eligibility** of ITS systems and applications for Federal funding has proven very important in removing past barriers to deployment. Most Federal-aid programs now cover

[5] Use of Incentives to Encourage ITS Deployment, US DoT Final Report, August 2014, Publication Number: FHWA-JP0-14-149

capital, operations, and some preventive maintenance costs as eligible expenses for Federal funding. ITS systems tend to have higher operating costs relative to their capital costs, when compared to traditional transportation improvements, such as adding a traffic lane. Since these costs are now explicitly covered by most of the large Federal-aid programs, state and local decision-makers are more willing to try ITS solutions.

Competitive grant programs for field trials and demonstrations serve a very important role in stimulating interest in a technology, using financial incentives. They assist the early adopters in entering the market and provide other agencies and industry with real world examples to follow.

While providing financial incentives is important, **encouraging sustainable funding for ongoing operations is even more important for ITS deployment**. The Department has found that in the traffic operations area, that while agencies are aware that Surface Transportation Program (STP) funds can be used for operations, most are reluctant to do so.

Many agencies have found it impossible for innovative technologies requiring a commitment to ongoing operations to compete with capital-intensive projects.

Deployment planning grants are generally viewed favorably by Federal officials and state and local stakeholders since they incentivize agencies to budget for implementation and operations and include ITS projects in their Transportation Improvement Programs (TIPs). For example, the recently announced Mobility Services for All Americans (MSAA) planning grants enable participating Metropolitan Planning Organizations (MPOs), Travel Management Coordination Centers (TMCCs), and other public agencies to work together to plan for human service transportation (HST) systems that utilize ITS capabilities to be included in their TIPs.

Rulemaking can be an important tool for motivating changes in behaviour, and can encourage (or mandate) ITS deployment. However, a very strong societal benefit-cost case needs to be made before requiring technology adoption.

Conducting KTT is a very important role for Federal agencies in incentivizing ITS deployment. **KTT includes: training, technical assistance, guidance documents, and peer to peer exchanges.** Training courses have been shown to be effective in answering some of the questions of state and local agencies about ITS technologies that may have impeded decisions to implement. Reducing the uncertainty about the risks and benefits of ITS is key to promoting adoption. In addition, delivering practical guidance and direct technical assistance on how to plan, analyze, and implement these technologies through guidance documents and state of the practice manuals or handbooks assists in standardizing procedures and creating a community of practice that will encourage deployment. These efforts should include mechanisms for peer exchanges, whether in-person or virtual, as research has shown that peer influence is an important factor in the decision to deploy ITS. The Every Day Counts (EDC) program shows how focused KTT, fully supported by the administration and agency leadership, is critical to influencing adoption of ITS technologies. Deployment of adaptive signal systems had been lagging in the U.S., but the EDC program helped to tum this around.

Demonstrating and communicating the benefits of ITS technology was most often cited as the factor influencing adoption. This applies to agencies, vehicle manufacturers, the trucking industry, and ultimately, the consumer. Telling the story of how ITS can be most cost effectively employed in combination with non-ITS improvements to increase safety, mobility, and operational efficiency is critical to expanding adoption of innovative technologies in surface transportation. The information must be communicated at the right level of detail and in ways that are easy to understand and compelling in terms of developing the business case for deployment.

Looking to the future. CV deployment depends on consumer adoption of the technology. The Department is considering exploring the concept of **providing incentives for consumer adoption**, including consumer education efforts such as NHTSJ\:s New Car Assessment Program (NCAP). The Environmental Protection Agency's (EPA) Energy Star program. And working with Congress and the Treasury Department to consider tax credits for purchasing the technology. as was done with electric vehicles and some Energy Star purchases.

To conclude, the reports points at the following set of incentives:

- Funding support of various kinds, and not the least to increase the eligibility of ITS as part of or instead of infrastructure investments.
- Providing grants and support also to planning exercises.
- Support to field trials and demonstrations through competitive grant programs (i.e. comparable to CEF calls, Horizon 2020 etc.)
- Secure continuous financing of legacy systems and operation of existing systems.
- Legislation / directives as tools for steering behaviour and processes
- Knowledge building, including education, training, technical support etc.
- Providing best practise knowledge from planning to implementation
- Harmonization, including preparation of handbooks and standardized procedures which will support in creating communities (i.e. platforms)
- Creating knowledge on and communicating the benefits of ITS

4.4. Reflections from CEF Corridor Coordinators Issues papers

The 2013 TEN-T Guidelines set a range of binding standards for infrastructure development as well as for transport services to become safer and more energy efficient. The guidelines include, for example, reinforced provisions on ITS deployment in connection with traffic management and multimodal transport solutions.

Complementary to the traditional infrastructure approach, the CEF Corridor Coordinators have together made a deeper analysis of areas which are situated at

the interface between infrastructure development and service operation or transport policy challenges must be integrated. The following five issues have therefore been looked at in more detail in the Issues Paper[6]:

- Enhancing multi-modality and efficient freight logistics
- Boosting Intelligent Transport Systems
- Boosting new technologies and innovation
- Effectively integrating urban nodes
- Extending cooperation with third countries.

For this report we have searched for ideas on instruments (drivers, incentives) that are proposed as part of the strategy.

1. Promoting ITS/ Boosting investments

To boost Intelligent Transport Systems, a coordinated ITS deployment beyond the so-called ITS corridors (also including in nodes) must be promoted; building on the C-ITS Platform and the Amsterdam Declaration, investment in digital infrastructure shall be stimulated to deploy cooperative intelligent transport services by 2019; new mobility services shall be enabled by enhancing data accessibility trough national access points and by linking travel information services along corridors.

2. Enabling multi-modality and freight logistics

To enhance multi-modality and efficient freight logistics, terminal infrastructure, terminal accessibility and relevant ICT infrastructure need to be developed from a reinforced corridor-wide perspective, as well as with a better integration of users' needs and demand forecasts; selected corridors shall serve as test cases for the digitalization of freight transport.

3. Boosting new technologies and innovation

To further boost new technologies and innovation in transport, the governance and cooperation structure of the corridors shall be used to the best of its possibilities to deploy results of research and innovation activities in line with strategic transport policy objectives, to boost common commitment of actors (researches, industry, TEN-T stakeholders) and to create strong "flagship" cases.

4. Effectively integrating urban nodes

To better integrate urban nodes into core network corridors, it is not only important to remove bottlenecks and missing links on TEN-T infrastructure in such nodes; a stronger connection with Sustainable Urban Mobility Plans can vitally contribute to improving "last mile" connections for people and freight; urban nodes shall make best use of their exemplary roles on multi-level governance and as forerunners of innovative and low-carbon solutions.

[6] ISSUES PAPERS OF EUROPEAN COORDINATORS, 2016-05-12

5. Extending cooperation with third countries

Cooperation between the EU and third countries on transport infrastructure development is important in order to ensure continuity of the TEN-T and its corridors in different geographical areas and thereby to facilitate trade and international cooperation; this must also involve the common striving for coherent standards.

Through this text, our analysis provides the following examples of incentives / drivers for innovation and ITS deployment:

- Promotion of coordinated ITS deployment, building on platforms and joint declarations
- Stimulated investment in digital infrastructure to deploy cooperative intelligent transport
- Development of test cases for digitalization of freight transport
- To build on common commitment of actors and the creation of flagship cases
- Find solutions to last mile connections for people and freight
- Remove bottlenecks and missing links

The strive for coherent standards

4.5. EU EIP topic papers

With background in the internal EU EIP SA 4.3 workshops and, among others, knowledge from reports and studies made, the EU EIP ITS Deployment Road Map task force developed a set of overarching topic papers as input for a workshop held in May 2018. These topic papers and the concluding workshop discussion[7] constitute basic input for the analysis of ITS Deployment drivers reported in the following chapter. The topic papers (TP) are provided as annex to this report:

TP 1: Effective cooperation, the need for platforms

TP 2: Alleviating Bottlenecks and Assessing the Benefits in the Context of Trans-European Corridors

TP 3: Financial support as a driver and enabler – Case study NEXT-ITS and NEXT-ITS2

TP 4: Regulations and other guidance tools as drivers for corridor development

[7] Reported in *How to turn your infrastructure into high performance transport corridors?* Proceedings from workshop, Brussels 17 May 2018

5. Conditions and Deployment drivers

5.1. ITS Deployment drivers create conditions for ITS deployment

On a high level, transport system development aim at creating a safe, secure, sustainable and efficient transport system contributing to the EU Internal Market and competitiveness objectives.

These high level aims constitute the background to a large number of initiatives on European, national, regional and local level. Initiatives that may result in policy measures, financial support, research and development, new infrastructure etc. all requiring investments in ITS. In the EU EIP ITS Deployment road map development we are focusing on specifically the driving forces behind deployment of ITS. What is it that makes ITS investments take place, and what forces are there to support ITS that contribute to a seamless and harmonized European transport system? These forces are here referred to as ITS Deployment Drivers.

A ITS deployment driver is a **means to create conditions that have impact** upon investment in and/or development of ITS. We distinguish between direct drivers that require ITS investment, and indirect drivers that stimulate ITS investments, aware of the fact that the border between these is not distinct.

In order to assess how strong and efficient a driver is we need to define:

a) Which conditions that are supported (or affected) by a specific driver

b) How strong the driver is in relation to creating the conditions

c) How important the conditions are in order to lead into ITS deployment

This section will provide an analysis of ITS deployment drivers strength based on these three aspects.

5.1.1. POSSIBLE CONDITIONS DESIRED

Following the literature study, results of workshops etc, the following conditions (state of play) are considered to support harmonized and synchronized ITS deployment on road transport corridors:

A. Availability of funds allocated for ITS investment;

B. Harmonized ITS systems and services; availability to standards etc facilitate procurement and deployment

C. Synchronized investment plans; simultaneous need from (e.g. neighbouring) several actors

D. Urgency; immediate needs speeds up investments

E. Predictability; knowledge of expected effects support the use of ITS

F. Business interest; many potential suppliers and future profit expectations drives the deployment and use of ITS

G. Backward compatibility; preserving value of previous ITS investments (legacy systems)

H. Simplification; making ITS deployment and use technically easier

I. Knowledge; access to knowledge and awareness of ITS options speed up and facilitate deployment

Some of these conditions follow directly from related drivers. E.g. education is an obvious generator of knowledge, hence the driver *Knowledge development* will support ITS deployment.

One could argue that "user demand" is a condition that should have been included in the list above. In our analysis we have found that user demand is more directly oriented towards features of vehicles (related to performance regarding safety etc.) which is not related to corridor performance, or is reflected through business potential, i.e. suppliers on the market that have identified an underlying "user demand" for certain conditions. Hence the presence of demand shall be seen as included in the "business interest" condition.

For each driver we will analyze which of these conditions that are supported and how strong the support is. It is important to recognize that a driver may support a certain condition and at the same time work against other condition.

5.1.2. DIRECT DRIVERS

Direct drivers create conditions that **require** ITS deployment, i.e. they meet legal obligations (including policy decisions) or follow from physical needs in the network. Direct drivers are in general quite strong, but they may need support from indirect drivers to initiate or speed up deployment. E.g. the legislation on e-Call required complementary harmonization.

1. Need for ITS in existing network (e.g. to alleviate specific bottleneck situations, manage traffic safety black spots, solve local environmental problems etc. in the network)
2. Need for ITS following from building of new physical infrastructure (roads, tunnels, bridges, mode interchange points etc.)
3. Maintain function of legacy ITS systems (replacing and upgrading)
4. Financial support to specific ITS deployment actions (incl. conditions)
5. Regulations/legislations demanding ITS implementation (e.g. e-Call, delegated acts)

5.1.3. INDIRECT DRIVERS

Indirect drivers create conditions that **stimulate and support** ITS deployment. They are often driven by research and innovation forces together with business development. Indirect drivers are not individually strong enough to drive deployment. They are supportive and add additional strength to direct drivers.

6. Availability to best practice, i.e. awareness of good examples
7. Harmonized systems and services (availability of standards, modularization)
8. Push for intermodal transport
9. Platform availability (Cooperation)
10. The CEF corridors in themselves
11. Personal interests (the idea of champions)
12. Profit potential (Business Development)
13. Knowledge development (education, development projects etc.)
14. Technical (e.g. product) development

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5.2. Deployment driver descriptions

Common for all drivers is that they through different mechanisms (means of acting) create a certain state of play, i.e. conditions to which ITS Deployment is a possible solution. These characteristics are described for each driver below.

5.2.1. NEED FOR ITS IN EXISTING NETWORK

5.2.1.1. CONTEXT

As has been seen[8], the most important driver for new ITS deployment is a direct need to solve a local traffic problem by managing the flow of traffic on the link, in the intersection etc. This may be the implementation of a ramp metering system, cameras for rapid incident detection in tunnels etc.

5.2.1.2. MEANS OF ACTING

The driver (need) acts through creating a strong demand from the public, from road users, from traffic operators etc. to solve a critical problem.

5.2.1.3. DESIRED STATE

[8] A5 deliverable Update of the Roadmap v1.1 2015

The road operator decides to proceed with local investments to solve local problems.

5.2.2. NEED FOR ITS FROM NEW INFRASTRUCTURE DEVELOPMENT

5.2.2.1. CONTEXT

New infrastructure elements (road sections, tunnels, bridges etc.) are in general more equipped with ITS ("more connected") than older parts of the network. In new infrastructure, ITS investments constitute approx. 10% of infrastructure costs.

5.2.2.2. MEANS OF ACTING

Infrastructure development drives ITS deployment.

5.2.2.3. DESIRED STATE

The road operator include ITS components in the design of new infrastructure elements.

5.2.3. REQUIREMENT TO MAINTAIN FUNCTION OF LEGACY SYSTEMS

5.2.3.1. CONTEXT

Around 50% of all ITS investments are spent on maintaining and upgrading functionality of legacy systems[9] e.g. exchanging old VMS panels with new to improve readability and lower energy usage

5.2.3.2. MEANS OF ACTING

This driver is generally present in the road operators regular planning. Upgrading is planned a couple of years ahead and included in maintenance budget.

5.2.3.3. DESIRED STATE

The re-investment / system upgrade is included in road operators budget and planning ahead.

5.2.4. FINANCIAL SUPPORT TO SPECIFIC (CONDITIONAL) DEPLOYMENT ACTIONS

5.2.4.1. CONTEXT

Support to investment through co-financing lowers the threshold to investment,

Financial support is often provided on the condition that the action support interoperability. This is typically done through open or closed calls in response to policy decisions and can take place on European, national or regional level.

5.2.4.2. MEANS OF ACTING

[9] A5 deliverable Update of the Roadmap v1.1 2015

The support could be conditional to specific ITS investment. A good example is the CEF Transport Call where a certain budget is allocated specifically to investments in C-ITS development. It could also be more open ("seed money") and functioning as a general stimulation to invest.

5.2.4.3. DESIRED STATE

An agreement is entered between the provider of financial support and the recipient in which the support is conditional to certain ITS investments being made within a specific time frame, in a specific area and using specific design etc.

5.2.5. REGULATION/LEGISLATION DEMANDING IMPLEMENTATION

5.2.5.1. CONTEXT

A good example is the EU Directive on e-Call which from certain date demand new cars to be equipped with specific equipment and that PSAP´s are established to receive and manage e-Calls. Also the delegated acts following from the ITS directive have stimulated ITS deployment.

5.2.5.2. MEANS OF ACTING

Regulations/legislation work in different manners and with different strength; The directive on e-Call prescribes equipment of vehicles from 2018 while the delegated acts following from the ITS directive defines the provision of specified services if certain conditions apply.

5.2.5.3. DESIRED STATE

The desired state is that a regulation shall require or point at the implementation of a certain service with enough precision in terms of design, network covered and timing of deployment.

5.2.6. BEST PRACTISE AVAILABILITY

5.2.6.1. CONTEXT

The idea of providing availability to best practise knowledge is to prevent "innovating the wheel" time after time. If there is a good and working implementation of a system or service, a follower can save tremendous time in the design and procurement phase. Best practise also provides good ideas on how different problems can be resolved.

5.2.6.2. MEANS OF ACTING

Availability to best practise knowledge shortens time between perceived need and possibility to deploy. In particular if access to design solutions can be provided.

5.2.6.3. DESIRED STATE

Knowledge of best practise is easily accessible for all actors that need a solution to a specific problem.

5.2.7. HARMONIZATION (AVAILABILITY OF STANDARDS, MODULARIZATION)

5.2.7.1. CONTEXT

Availability of standards (or similar documents) provides shortcuts to specifications, lowers cost for procurement etc. Standards are also key to interoperability between systems and services and sometime a prerequisite for anything to happen.

5.2.7.2. MEANS OF ACTING

Availability to standardized (harmonized) solutions shortens time for specification and implementation.

5.2.7.3. DESIRED STATE

Presence of known and adequate standards for ITS systems and services.

5.2.8. PUSH FOR INTERMODAL TRANSPORT

5.2.8.1. CONTEXT

The development of a sustainable transport system calls for optimum use of combinations of transport modes. This will require as well infrastructures for mode change activities as ITS applications supporting mode change and mode use balance.

5.2.8.2. MEANS OF ACTING

As intermodality is policy driven, the requirement for ITS will follow as a result. Stakeholders representing all transport modes are seeking solutions to enable intermodal transport, and to offer alternative modes (multimodality) to transport needs.

5.2.8.3. DESIRED STATE

Development of inter- and multimodal transport solutions which will require demand for ITS deployment.

5.2.9. PLATFORM AVAILABILITY (COOPERATION)

5.2.9.1. CONTEXT

Responsibility for transport infrastructure and associated ITS systems and services are in general local / regional. Harmonized, synchronized and seamless services across (juridical) borders require that responsible stakeholders meet in order to align plans and solutions. It has shown that platforms, i.e. organizational arrangements for stakeholders to meet, discuss and agree on solutions, facilitate in particular establishment of cross-border ITS deployment initiatives.

5.2.9.2. MEANS OF ACTING

The platform enables exchange of best practise, synchronization of plans and harmonization.

Availability to best practise knowledge shortens time between perceived need and possibility to deploy. In particular when access to design solutions can be provided.

5.2.9.3. DESIRED STATE

Established platforms for harmonization, cross-fertilization etc.

5.2.10. THE CEF (TRANSPORT) CORRIDORS IN THEMSELVES

5.2.10.1. CONTEXT

The CEF corridors can be seen as a representation of a supranational infrastructure which is built on combining national transport segments and nodes into a combined structure.

5.2.10.2. MEANS OF ACTING

The idea of a transport corridor calls for actors to harmonize a range of characteristics to allow for seamless transport along the corridor, and also to put in place a structured governance for the operation of the corridor. The fulfilment of the corridor requires continuity of services, which in turn calls for harmonization and synchronization. The corridor will put a pressure on the concerned stakeholders to implement the systems and services required. A typical example would be that the corridor calls for all member states concerned to implement ERTMS to allow for railway interoperability.

5.2.10.3. DESIRED STATE

Stakeholders concerned (e.g. road operators along the corridor) agrees on a plan including which services that shall be put in operation and the timing of this.

5.2.11. PERSONAL INTERESTS (THE IDEA OF CHAMPIONS)

5.2.11.1. CONTEXT

There are many examples where strong personalities plays an important role in the development and implementation of innovations. They can also act as ambassadors and/or acknowledged experts in support of certain products or services, but regardless they act through convincing their environment to work in a specific direction.

The importance of Champions has been recognized by the EC through e.g. the appointment of the Corridor Coordinators for the CEF corridors.

5.2.11.2. MEANS OF ACTING

A Champion uses personal influence and network to “make things happen”. By personal engagement and using many channels important stakeholders get

convinced to contribute to development and/or the implementation and use of specific systems and services for specific purposes.

5.2.11.3. DESIRED STATE

A particular group of stakeholders under the influence of a recognized and driving champion agree to carry out synchronized and harmonized investments in accordance with a vision or plan for development established. Governance established for the continued operation of systems and services.

5.2.12. PROFIT POTENTIAL (BUSINESS DEVELOPMENT)

5.2.12.1. CONTEXT

The prospect of earning money is a strong driver for development. In new infrastructure development, ITS investments will cater for 10% of the investment cost and more. Also during the operational phase ITS will bring considerable costs for maintenance, upgrades etc. This means that ITS provides important business opportunities for consultants, suppliers of equipment etc.

5.2.12.2. MEANS OF ACTING

Profit potential speed up investment and shorten time to deployment. Companies and other actors will put pressure on developers and prospective clients (e.g. road operators) to invest in new and/or extended systems and services. This is done through marketing, cooperation in pilots and projects, joint research etc.

5.2.12.3. DESIRED STATE

Enterprises become aware of and interested in deployment of ITS systems and services as they see a potential to earn money. Stakeholders decide to invest in ITS.

5.2.13. KNOWLEDGE DEVELOPMENT

5.2.13.1. CONTEXT

Knowledge of the potential of ITS will support in finding ITS solutions instead of and complementary to traditional infrastructure development. Hence all kinds of knowledge development will create greater demand for ITS.

5.2.13.2. MEANS OF ACTING

Knowledge of possibilities and advantages with ITS will generate investments. Knowledge of effects and benefit to cost ratios will stimulate ITS investments.

5.2.13.3. DESIRED STATE

As many actors as possible should have knowledge about ITS and which effects that can be achieved.

5.2.14. TECHNICAL (E.G. PRODUCT) DEVELOPMENT

5.2.14.1. CONTEXT

Technical development is a driver in itself. Development lowers costs for systems and services and allow for new features to be included. Hence the possible value of ITS deployment will increase.

5.2.14.2. MEANS OF ACTING

Technical development acts by putting new products on the market which opens up for new or improved functionality of ITS systems.

5.2.14.3. DESIRED STATE

Availability to a range of good and harmonized products from competing suppliers.

6. Deployment driver assessment

6.1. Assessment methodology

The purpose of the deployment driver analysis is to identify the drivers that are considered as most efficient in terms of driving the development towards the goal set. The resulting ITS deployment road map will be based on this result.

The assessment has been made based on an analysis of to what extent the drivers contribute to the realization of a scenario for a safe, efficient and sustainable European road transport system that comply with regulations. This system is enabled by use of ITS for controlling, managing, advising and informing road users before and during the transport which may be made by trucks as well as passenger cars.

Focus is on the Core and Comprehensive European road network and corridors, but the assessment has also taken into account needs and possibilities related to secondary and urban road networks.

A range of ITS tools are available for this purpose, as described in the first deliverable[10]. The experts carrying out the assessment have used their own considerations regarding which ITS tools that may be considered relevant for the analysis.

6.1.1. METHODOLOGY

The assessment is carried out as a multi-criteria analysis in three steps, where the first two steps are based on respondent input, and the third step is generated from the input:

6.1.1.1. STEP 1: A VALUE IS ASSIGNED TO EACH CONDITION

There are nine conditions (state of play) identified which contribute to the realization of the target scenario:

A. Availability of funds allocated for ITS investment;

B. Harmonized ITS systems and services; availability to standards etc facilitates procurement and deployment

C. Synchronized investment plans; simultaneous need from (e.g. neighbouring) several actors

D. Urgency; immediate needs speeds up investments

E. Predictability; knowledge of expected effects stimulates ITS investment

[10] D1 ITS Vision, EU EIP SA4.3

F. Business interest; many potential suppliers and future profit expectations facilitate deployment

G. Backward compatibility; preserving value of previous investments (legacy systems) facilitates ITS investments

H. Simplification; making deployment technically easier will lower the threshold to ITS investments

I. Knowledge; access to required knowledge speed up and facilitate deployment

In the analysis the respondents have assigned a relative value to each condition reflecting its relative importance, and the sum of these values should be 100 for each respondent. Hence the respondent estimated the relative importance of each condition in terms of driving ITS deployment.

6.1.1.2. STEP 2: B - ASSIGN A VALUE TO THE STRENGTH WITH WHICH EACH DRIVER SUPPORT EACH CONDITION

14 drivers have been identified. Each driver contributes to each condition with a strength rating from -1.0 to +1.0. Where the impact is considered negative, i.e. the driver is preventing the condition to occur, or makes the condition develop in the wrong direction, a negative figure is used. Difference has been made between 0, meaning “no effect” and “blank” which means Not relevant.

The rating shall be understood as follows:

-1.0	Very negative contribution from the driver, it not only prevents the condition to occur but makes the condition to develop in the wrong direction (e.g. “destroys knowledge”)
-0.99 to -0.51	Strong negative contribution
-0.5	Intermediate negative contribution. It prevents the condition to occur
-0.49 to -0.01	Weak negative contribution
0	Neutral, no impact on the condition
0.01 – 0.49	Weak positive contribution
0.5	Intermediate positive contribution. It clearly contribute to the condition to occur
0.51 – 0.99	Strong positive contribution
1.0	Very Strong support to the condition to occur (e.g. “builds knowledge”)
Blank	Not relevant

The results are provided in a matrix where each of the 14 drivers have been assessed against the 9 conditions (see Table 1 below).

6.1.1.1. STEP 3: MULTIPLY CONDITION IMPORTANCE WITH DRIVER STRENGTH

By multiplying the importance value of each condition with the level of strength each driver support this condition, a resulting table is created which can be analysed in several ways, e.g.:

- The resulting ("total") strength of each driver can be derived by summing up its contribution to each of the conditions, accounting for their relative importance.
- The resulting importance of each condition can be derived from adding its contribution from each of the drivers.
- High values of specific combinations of conditions and drivers will indicate where it is of particular importance to apply measures

The resulting tables together with our analysis is provided in the following section.

6.1.2. RESPONDENTS

The analysis is based on assessments made by individual or groups of respondents representing road operators in 7 European countries: Sweden, Norway, Denmark, Finland, the Netherlands, Romania and Germany.

6.2. Assessment results

6.2.1. CONDITION IMPORTANCE VALUES

The resulting assessment of the importance of the conditions shows as follows (the resulting sum of conditions is 100):

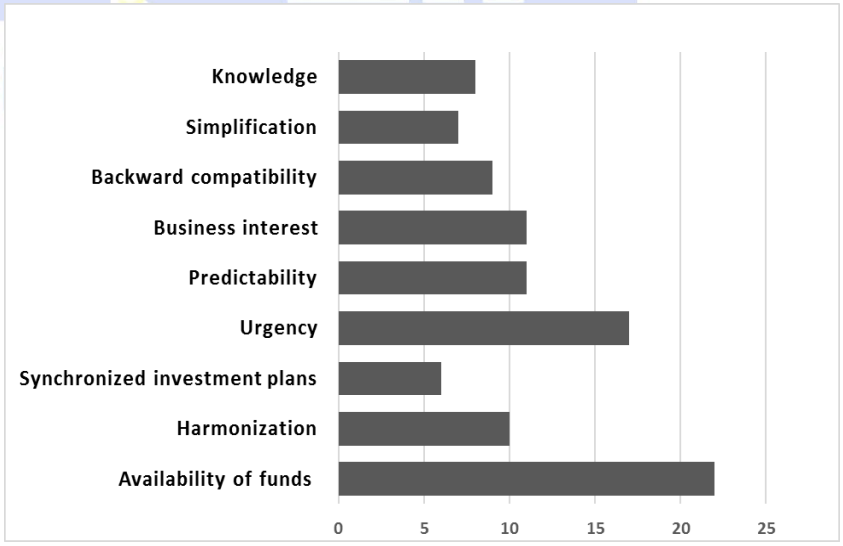

Figure 1: Table of relative Condition importance values

It is evident that the respondents identify Availability of funds allocated for ITS investments together with Urgency as the conditions that are the most important generators of ITS investments (which could be summarized as Time and Money). This points out to importance of funds being available at most times especially when there is an urgent need uprising.

Then we can see that a group of conditions relating to supply of systems and services follow: Business interest and harmonization in place. This would reflect e.g. organizational changes and the growing interest from new, commercial, stakeholders to engage in transport system development and the need for harmonization to support e.g. interfaces between actors. Also public actors see the importance of this and the impact of technical development.

Concerning conditions with lowest rank, we can see that dependency of "neighbours" and what they do have limited impact and also that the need for "available knowledge" is not considered as an important condition. Presumably knowledge is acquired when needed and planning and ease of deployment is not really aiding the deployment in itself.

Values in 'Harmonization in ITS system and services' and 'Predictability' reflects the role of knowledge of effects in facilitating various deployments.

6.2.2. DRIVER STRENGTH VALUES

When looking at the ITS deployment drivers in general, we can see the following result when adding how much each driver contribute to each condition and accounting for the relative importance of the condition (i.e. the total driver strength):

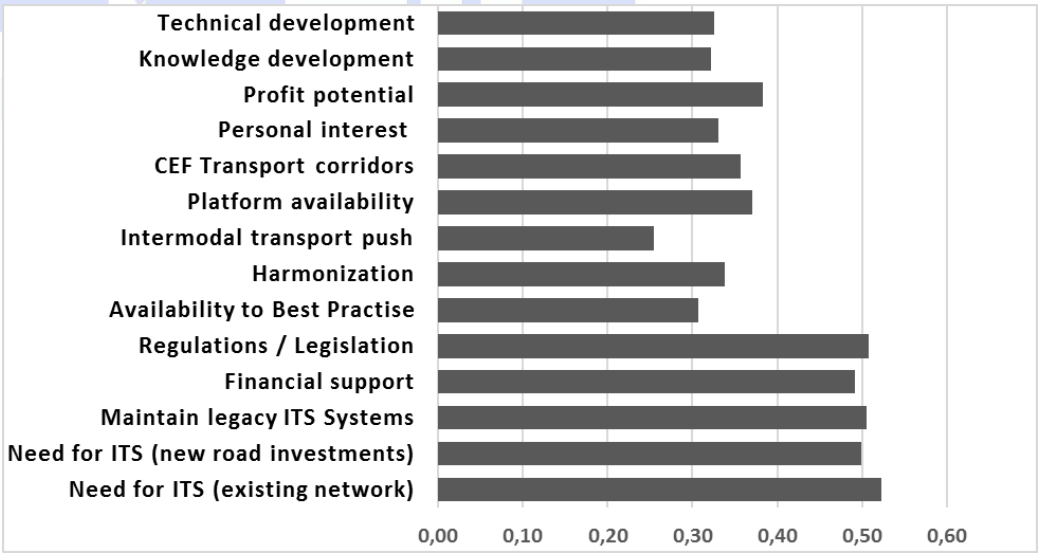

Figure 2: Relative strength of ITS Deployment drivers (maximum 1.0)

It is clear that those drivers that were considered as “direct drivers” are given higher impact value than the “indirect drivers” when looking at the general picture.

Lowest score of all drivers is given to “push for intermodal transport” which also reflects how ITS investments are actually made, i.e. not against policies but local need.

All drivers, considering their total contribution, show a clear positive total impact, i.e. they are seen to contribute to demand for ITS deployment on transport corridors. Given that this assessment was carried out by road operators, the values corresponding are what they individually consider important or less important.

From the first look, it is evident that all the direct drivers got a fairly high score compared to the indirect drivers which further attest the division of drivers into direct and indirect based on their impacts to ITS deployment. We can also see that the strength of drivers are considered to be fairly equal within these groups even if there are some drivers that stand out. All the direct drivers reflect high scores with conditions in particular to Availability of funds and Urgency which also corresponds to the high values the two conditions were given in the assessment before, meaning they have the highest impacts on ITS deployment. Other conditions which corresponds to direct drivers more than other are ‘Business interest’ and ‘Harmonized ITS systems and services’ which both points out to better facilitating ITS deployment through current and future business needs. Looking at the top score we can also see that need for ITS in existing infrastructure together with a good commercial business case for the systems and services needed together form a very strong combination.

6.2.3. COMBINING DRIVERS AND CONDITIONS

Considering that we have observed moderate differences when looking at conditions and drivers per se, the multi criteria analysis gives much larger differences when the combination of drivers and conditions is considered:

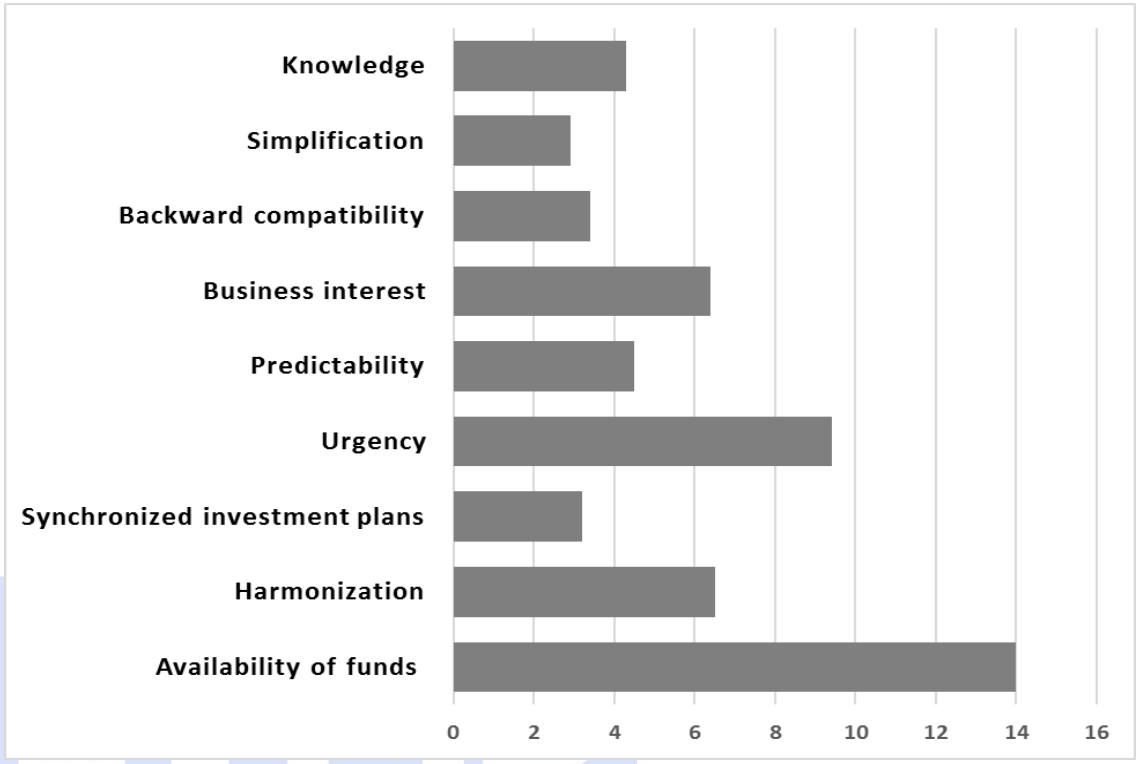

Figure 3: Condition values considering impact from drivers

As the figure shows, the importance of fund availability (i.e. access to money) stands out as the key to ITS deployment. A good second is immediate need (urgency), i.e. where ITS is found to provide a relevant solution to current road network problems this is also an important trigger for investments.

Looking at the driver Regulation/legislation demanding ITS implementation, it contributes to a wide range of conditions like Availability of funds, Harmonized ITS system and services, Synchronized investment plans, Urgency and business interest.

From a corridor perspective it is a bit disappointing to see that “synchronized investment plans”, i.e. the presence of simultaneous and similar need from neighbouring or cooperating stakeholders is not considered as an important driver. Also, access to knowledge and simplification, which both reflects a condition where ITS deployment is made “easy”, is not considered important. Turning that around, we can likely conclude that absence of knowledge or complicated systems are today not considered as barriers to ITS deployment.

6.2.4. DETAILED TABLE ANALYSIS

Each specific combination of a driver and a condition is reflected in a specific value in the table below. Combinations of particular importance are shown in green, while less powerful combinations are tuned in red:

Driver / Condition	A	B	C	D	E	F	G	H	I	Total
Need for iTS in existing network	16	6	2	13	3	5	4	1	2	52
Need for ITS following from new infrastructure investment	17	4	2	12	2	6	2	2	2	50
Maintain function of legacy ITS systems	15	4	3	11	3	5	7	2	2	51
Financial support (to specific ITS deployment actions)	15	5	4	10	3	6	3	2	2	49
Regulation / Legislation demanding ITS implementation	16	6	4	11	2	5	2	2	1	51
Availability to / Knowledge of best practise	4	7	1	3	5	3	1	3	4	31
Harmonization (availability to standards, modularization)	3	9	2	2	4	4	4	3	3	34
Push for intermodal transport	7	3	2	4	2	4	0	1	2	25
Platform availability (cooperation)	8	5	3	5	4	3	1	2	4	37
CEF (road transport) Corridors as such	11	4	3	5	3	3	2	1	3	36
Personal interests (presence of champions)	13	3	2	7	3	2	0	1	3	33
Profit potential (business interest)	9	2	1	7	2	9	2	3	3	38
Knowledge development	3	3	1	2	7	3	3	4	6	32
Technical (e.g. product) development	5	4	1	3	3	7	3	4	4	33
Average	10	5	2	7	3	5	2	2	3	
Total	142	65	32	94	46	64	35	30	43	

Table 1: Combinations of conditions (A – I) and drivers

As can be seen there are several combinations with very low values (2 and under). These are combinations to be considered as almost irrelevant. What would be interesting is if there are specific combinations that stand out.

We can see that condition A; Availability of funds allocated for ITS investment has significantly higher importance than other conditions (with the total of 142, viz 50% more than the second most impactful condition). Other most impactful condition derived is Urgency (D) followed by Harmonized ITS system and services (B) and Business interest (F) close by, while Simplification (H) and Synchronized investment plans (C) were derived as least impactful conditions.

Push for intermodal transport is seen to be the least impactful driver, probably because the experts contributing to this evaluation are all road operators and work more closely with corridors and not urban environment where intermodality is vital.

7. Conclusions and way forward

This report provides background information to the EU EIP ITS Deployment Roadmap report which will be the final deliverable.

In previous ITS Deployment Roadmap work focus have been on identifying possible timing of when different systems and services will face deployment with much consideration to technical development and the expected maturity of systems and services at different moments in (future) time. Such work is also ongoing in parallel to this work and reported through several studies, not least within EU EIP (e.g. work in sub-activity 4.2).

What we have seen in this study however, is that from a corridor perspective and considering the relevant stakeholders in corridors development, technical development is not a key driver behind deployment of ITS systems and services needed for transport corridor development, it is rather supporting other development as an enabler.

Instead availability to funds, regulations, legacy systems, access to platforms and immediate needs in response to network bottlenecks etc. are in focus for planners related to transport corridors.

It is also important to recognize that the analysis made is very much based on the view from current practise and experience, which is based on traditional organization of the transport system where road authorities and operators, i.e. infrastructure managers, are leading. Strong forces from digitalization and automation may change this as new actors come in and new possibilities for traffic management emerge. Hence we can expect that new forms of cooperation ("platforms") will develop driving the implementation and operation of new types of systems and services.

At least partly, the results underline a need for road maps and more strategic thinking - currently deployment of ITS appear somewhat as day-to-day management, without well considered long term plans based on reliable knowledge about the expected impacts, and management of parallel activities and measures in coordinated way. This also highlight the importance of CEF corridors or a similar structure as the basis for coordinated ITS deployment.

This must be taken into account in ITS Deployment Roadmap development. Hence the continuation of the work will have to focus on

- Packaging ITS deployment drivers into incentives for ITS deployment on transport corridors
- Identifying measures that will support drivers creating conditions of importance to transport corridor development
- Include the foreseen impact from opportunities stemming from digitalization and new actors getting involved in transport system development, and the changing role of traditional infrastructure providers and traffic managers

- Develop recommendations for EU (INEA, DG MOVE), Member States and other stakeholders on how they shall optimize the value of the support they provide, and how they shall stimulate ITS deployment through incentives.

This work is planned to be reported in November 2019.

8. References

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9. Annex : Topic Papers for EU EIP ITS Deployment Road Map workshop 17 May 2018

9.1. TP 1: Effective cooperation, the need for platforms

Introduction to the topic

Corridors link the domains of different Road operators. CEF corridors, defined as multi-modal, also require that different modalities are interfaced. Since it is the core task of each road operator to take care of their own domain, as it is for other modal operators, the question is what mechanisms can help realise the interfaces and cooperation to realise corridors. Obviously this should not require excessive effort from operators. Various mechanisms and examples will be presented and discussed.

Current situation

The infrastructure world today is very much organised in a modal way. Each operator is focussing on his own domain, where they are doing a great job managing traffic, taking care of safety, and providing information to both service providers and end users. At the same time both construction and operation of the infrastructure are increasingly considering the reduction of impact on the environment and resilience against climate change.

The **use** of infrastructures at the same time is becoming more multimodal, most clearly in freight transport, but passenger transport following. In freight transport we see that the market very much is organizing itself, but in support of inter-modality transfer points, parking places, traffic management, incident management, information on traffic and on restrictions, etc. are needed.

European policy is working under the banner of achieving the Single European Transport Area, which includes the realisation of the multi-modal Trans European Core Network by 2030, the comprehensive TEN-T network by 2050 as well as a number of initiatives to improve urban transport and multi-modality while addressing safety, resilience and climate change.

The CEF programme covers realisation and implementation of the TEN-T, including hubs and digital systems and services such as SESAR (air), ERTMS (rail), RIS (IWW) and ITS (Road). ITS is defined as for roads and interfaces to other modes. 9 multimodal CEF corridors have been defined on the TEN-T core network of Europe, e.g. ScanMed, North Sea - Baltic, North Sea- Mediterranean. Their work plans consume 90+ % of CEF budget (24 B€) and are almost completely focused on realising national hard infrastructure. In order to cater for its use and promote aspects of European added value, in 2016 the so-called issue papers have been published covering horizontal issues, e.g. ITS and multimodality.

European regulation for ITS is rooted in the ITS Directive (2010/40/EU) and has produced 5 delegated acts so far, in chronological order:
E- truck parking information, static and dynamic

C- safety related traffic information
D- eCall
B- Real Time Traffic Information (including static road data!)
A- multi-modal travel information and route planners
C-ITS is underway and planned to be published end of this year.

All specifications require installation of a National Access Point where datasets can be found based on their meta-data. The data should be made available in prescribed standards.

Existing platforms cover a wide range, some organised as European projects with a final date, typically 2020, others of a permanent nature. Here under some of them e.g.:

EU EIP

Knowledge centre. Cooperation of Road Operators, -authorities and other stakeholders for the Europe-wide exchange of knowledge, agreeing harmonised approaches and quality levels.

EWC

An former activity, now work group, in EIP for identification of actual national plans which could/should lead to harmonization, for which guidance is provided.

CEF corridors

9 communities of, most national or regional, stakeholders along the corridor, led by national ministries. The corridors have work plans where all their implementation projects (most national or local along the TEN-T) are described and co-funded. Not much international or inter-modal cooperation so far. Maybe flagship projects will help improving that.

ITS corridors

5 international projects where national and local ITS projects along the TEN-T are being implemented, with some horizontal activities

C-Roads

Platform for the definition and first implementation of interoperability across Europe of C-ITS day-1 services

ASECAP (concessionaires), ACEA (OEMs), POLIS (urban ITS), etc.

All associations catering and lobbying for the interests of their members

CEN, ETSI, ISO

Standardization bodies dealing with ITS and more

DATEX organization

Stakeholder organization maintaining the DATEX standard

Need for development – the target situation

The end goal is optimal performance and seamless operation with European added value of the networks, both cross borders and cross modes, in principal from the perspective of the user, whether freight, passenger or private. For this, continuity of services will be required with adequate quality levels and harmonization of information and the services build on that information.

International Transporters and Travellers will require continuous information. It should be understandable and quality levels in different countries and circumstances should be adequate for the situation and known. Both road individual operators and service providers have roles to play, some are obvious, some can be mixed. One of the roles for service providers seems obvious: combining different data sources into end-user services. Hence data sources from operators should be available in standardised formats with known quality.

It is expected that roles will shift towards the future. Data sources from service providers may become useful for traffic management and could be used by road operators either as a more cost-effective solution or for enhancing coverage or service level. This can be for free or at commercial prices, depending on circumstances, arrangements or regulation.

For inter-modality, information from different sources should be available and easily accessible in standardised formats and at known quality levels. It is expected that inter-modal services can be based on those information sources by the market and service providers, as is happening already to a certain extent, e.g. the European multi-modal route planner for freight containers and its targeted version for the East-West Corridor.

Apart from user services, also cost savings for the construction, maintenance and operation of intelligent infrastructures maybe achieved, because of harmonised approaches and economies of scale. And in the intermodal field direct cooperation with modal partners may deliver integral and more effective and cost-effective solutions for transport, e.g. the cooperation between port, city and road operator in the Tallinn area.

Challenges ahead and possible solutions

Cooperation can bring benefits in a number of areas, e.g.

Strategic/Tactical
Better information about new developments, new legislation, new policies, market developments, where a body of colleagues can help appreciate and discuss the expected impact and possible approaches.

Tactical/operational
Exchange of best practice, such as provided by EU-EIP activities and supported by the Deployment Guidelines

Standardisation as in standardisation bodies and e.g. the C-Roads platform, where necessary profiles are being developed and agreed, necessary to make C-ITS vehicles work everywhere in Europe.

Cooperation on **cross-border implementation projects**, or cross corridor projects, usually based on priorities which already have been agreed on national and European level.

For efficient cooperation a number of conditions need to be fulfilled:

Awareness
Are the stakeholders aware that they share issues and that a common approach, even when not always being the optimal one for individual organisations today, has added benefits for the group as a whole or for end-users, or for society as a whole, or for the longer term?

Need
Who is the problem owner? When not 100% within an individual organisation, is there room to invest time and money for achieving benefits of supra-organisational nature or longer term?

Effort
Is staff and the required expertise available, or can it be hired? By whom?

Cost
What cost needs to be covered, what support is required and how is the remainder shared between the stakeholders regarding the overhead of a platform?

Champion
Usually there is one organisation, person, or association who takes the initiative and provides initial guidance to get a cooperation going.

All of the above needs to be addressed in some way in order to create inter-organisational cooperation

One realistic scenario can be modal operators, still catering for their own domain, providing and sharing information with their neighbours, with other modes and with service providers, while receiving information from them in return as well, in standardised formats.

This can be on a bilateral basis and accompanied with operational and tactical procedures for action, as laid down in Traffic Management Plans, protocols or other agreements.

But wider sharing along and between corridors requires more: platforms where common approaches are worked out, shared and agreed, and where a service layer is covering and linking the individual infrastructure domains. Next to common service levels between road operators and between other modal operators, the market is already playing a role and will increasingly do so. They seem well placed to cater for wider international and intermodal services, based on data from multiple sources and providing both collective and individual advice. And further to traditional information services, OEMs with connected and automated driving and the digital economy will increasingly need to be interacted with too.

So in the end the question remains which platforms do road authorities need for playing their roles in an efficient and effective way in the different situations of the evolving society and market as described above, what is needed to organise them, which should we continue and which should be added.

9.2. TP 2: Alleviating Bottlenecks and Assessing the Benefits in the Context of Trans-European Corridors

Five ITS corridors have been established by Member States which focus on the wider deployment of ITS systems and services to improve the efficiency of key trans-European routes. The corridors have some several objectives but common to all is improvement to their efficiency including the alleviation of bottlenecks and congestion which are key factors impacting effectiveness.

As an illustration, Arc Atlantique ITS Corridor has targeted alleviating of congestion and bottlenecks and is in the process of measuring the benefits of improving bottleneck congestion. These bottlenecks have been classified into either *recurrent congestion*: typically occurring every working day, and *'abnormal' congestion*: typically caused by events such as holiday traffic, or adverse weather.

The Arc Atlantique Corridor – Recurrent Congestion

The Arc Atlantique Corridor – Abnormal Congestion

The Arc Atlantique Corridor project includes partners from seven countries. There are 16 operators, each with bottleneck situations to address. Connecting Europe Facility funding is helping to support implementation of congestion alleviation solutions, and this Corridor is seeking to measure the performance and effectiveness of these measures using KPI's. This will allow the project partners to better understand the impacts, quantify the benefits, asses performance and help direct future investment decisions.

What are the problems caused by corridor bottlenecks?

Bottlenecks are a well-documented traffic management problem; with negative impacts on safety, mobility, the environment and the economy. Disruptions caused by bottlenecks range in scale, frequency, predictability, duration, and have the potential to impact a number of facilities or modes.

What ITS measures are implemented to alleviate bottlenecks?

For recurrent bottlenecks the most common ITS mitigation measures are:

- Operational improvements (ramp metering, dynamic lane management, Hard Shoulder Running, Active Traffic Management etc.),
- Capacity expansion (adding additional lanes, this can prohibitively expensive or politically unfeasible)

For non-recurrent / abnormal bottlenecks, appropriate actions that reduce the formation of bottlenecks include actions designed to reduce the occurrence of unpredictable events (e.g., changes that reduce the frequency and severity of incidents, special event management, weather warnings etc.), and activities designed to restore capacity after such these events (e.g. incident management, and snow and ice control efforts).

Example: An example of a measure implemented on the Arc Atlantique to alleviate recurrent congestion is the Variable Enforceable Speed limits implemented on the M25 in England to the north east of London.

Example: An example of a measure to alleviate non recurrent abnormal congestion is the implementation of DATEX 2 on the French motorway network to enable effective communication between traffic control centres, giving a faster approach to implementing traffic management plans.

What are the benefits, why and how can you measure them?

To effectively measure the success of a deployment incentive beneficiaries need to include a performance measure, undertake data analysis, or provide project results.

The benefits of applying ITS to bottlenecks are not easy to measure, traditional CBA is generally not applicable; but by trying to quantify the benefits we can begin to determine the effectiveness and value of ITS investments, help shape future investments, both locally and at a corridor level.

The most obvious benefits of alleviating bottlenecks are travel time savings for road users, with corresponding economic savings and environmental benefits. In line with this, the most widely calculated congestion and bottleneck benefits relate to travel time savings. When an effective intervention is implemented benefits are realised at both the local network level and the corridor level, since the corridor as a whole will operate much more effectively if disruptions caused by local bottlenecks are reduced.

The AA3 partners are planning to use Bottleneck Congestion KPIs to measure the effectiveness of ITS implementations. The EU EIP Evaluation Activity has defined a *Change in Bottleneck Congestion KPI.* This is the Total Delay or Vehicle Hours Lost expressed as the difference between the total time spent and a reference journey time.

Example: Transport Scotland have calculated travel time benefits on a central section of their motorway network, this section suffers from recurrent congestion and has several ITS systems in place (VMS, lane control and queue

management). Travel time savings were calculated using spot speed and link travel time data that is routinely collected.

Over a week the calculated benefit was 436 vehicle hours; for this exercise the delays were also converted to an economic cost to the economy, the estimated travel time savings benefit was calculated to be £67k. From this analysis it can be demonstrated that funded ITS on this road section has significant benefit to the corridor.

There are known challenges; including difficulty obtaining true baseline, assumptions are required, network complexity is an issue.

9.3. TP 3: Financial support as a driver and enabler – Case study NEXT-ITS and NEXT-ITS2

Objectives

The main objectives of the NEXT-ITS 1 & 2 corridor/CEF-projects were to improve the performance of the Scandinavian/Northern Germany NEXT-ITS corridor i.e. by improving the efficiency, reliability and safety of the corridor as well as to reduce the environmental impacts of road transport. These improvements were to be done primarily through a coordinated deployment of core European traffic information services in response to the European Priority Actions b) and c) of the ITS Directive, i.e. Real-time traffic information services and Minimum safety related traffic information services.

The total length of the NEXT-ITS corridor itself is about 3 000 km, but the impacts of the NEXT-ITS 1&2 measures cover a much larger road network, about 25 000 km. This is due to the fact that many measures focus on improving the effectiveness and quality of traffic management centre operations. In the participating countries, the traffic management centres of the road authorities provide their services on the whole comprehensive TEN-T network, and even wider, on the whole main road network including the arterials to the bigger cities connected by the main road networks. This was to be taken into account in cost-benefit calculations.

Methods for benefits estimations

The NEXT-ITS measures and deployments, e.g. upgrading of Traffic Centre capacity and improved travel time services, benefit a much larger network than the NEXT-ITS corridor only due to the nature of the services, by e.g. improving the content, quality and accessibility of the service as well as the area covered by the service. Hence, the cost of implementation was also allocated for each of those networks benefiting from the service.

Therefore, in the benefit calculations, the whole impacted network has been included into the calculations. For example, in the Finnish case the improved weather service influences all main public roads, a network that is more than 13 000 kilometres, the traffic condition and travel time related benefits affect a network of 5 600 km whereas the safety related information services only benefit part of the NEXT-ITS corridor, less than 300 km. Furthermore, the most extensive services (in NEXT-ITS2) including e.g. lane management, only very minor parts of the network was covered including a few tunnels. These different networks influenced per service have been taken into account in the benefit calculations per each country, and the benefits have been estimated one network (with one bundle of services) at a time.

CBA - how much benefits can be achieved with the investments?

The total estimated effects of the services in NEXT-ITS1 were considerable, about 1.8 million vehicle hours driven less and circa 166 000 vehicle hours less spent in

congestion annually. More than thirty severe accidents and 65 thousand tonnes of CO2 emissions were avoided annually due to NEXT-ITS. The total value of the annual benefits in 2016 was estimated to be circa 51 Million €, which was compared to the implementation costs of circa 36 million € including VAT and thereby comparable to the benefits (the costs without VAT amount to almost 30 Million €). As the annual operation and maintenance costs were estimated to be of 3 - 4 Million €, the NEXT-ITS project was assessed to be socio-economically feasible to a large extent.

The benefits of NEXT-ITS2 were a bit more conservative. In many cases this was due to ongoing deployment (the full benefits to be achieved later in 2018-2019 when the deployment proceeds). Still, e.g. the estimated main impacts of NEXT-ITS 2 measures are seen in improved traffic flow, indicated with the KPIs vehicle hours driven (reduced by almost half a million vehicle hours per year), and vehicle hours spent in congestion (reduced by 135 000 vehicle hours per year). This is a result of the deployed measures, which aims mostly at improving traffic and incident management, and supporting it with the improved traffic information. The total value of the annual benefits in 2017 will be circa 15 Million €, which can be compared to the implementation costs of circa 33 million € including VAT and thereby comparable to the benefits (the costs without VAT amount to almost 27 Million €). As the annual operation and maintenance costs will be in the order of 3 Million €, the NEXT-ITS 2 can be assessed to be socio-economically profitable.

Discussion

The results of NEXT-ITS1&2 were indeed considered positive. However, the effect estimates were based on a desk-top analysis, and needs to be compared to the actual statistics from the NEXT-ITS corridor and the national networks affected. Such an ex-post evaluation could be carried out when all the planned deployments are in full effect. However, it is clear that the effects of the services are extremely difficult to measure and will have to be estimated partly as it has been done in the ex-ante evaluation presented. In addition, it is clear that the effects of the services are extremely difficult to measure especially in this era of technology disruption due to connected and automated driving, the internet of things, digitalisation, etc. In addition, one aspect fully excluded in the current analysis is the “value of being informed” - i.e. even if the individuals are not changing their behavior, which could be measured by “traditional benefits”, they may value of being informed.

In all, due to the complexity of the evaluation of new ITS systems, even the ex-post evaluation is good to be accompanied with a summarizing desk-top analysis, by evaluation experts, similar to the ex-ante assessment reported here. Overall, the general conclusion is that well-planned ITS investments are profitable for the society.

The remaining question, however is, how to estimate the effect of financial support in this kind of cases? According to CEF-rules, the projects selected are the ones which would have been deployed in any case. However, one could state that the deployments may have covered wider area, and hence having more networks (and hence drivers) affected or that the deployments may have been faster or that the deployments may have been with higher quality due to extra funding. Since the

estimated benefits per one driver are small, the overall benefits, and hence the CBA is very much depending on all those three aspects: coverage, timing, and the quality of the service, all of which are potentially improved with the extra financial support, even in the cases of lower (10-20%) support rates.

It has also been concluded (ref US DoT) that financial support in the form of grants and other subsidies are particularly important in earlier stages of development when also policy objectives are to be considered. Demonstrations, pilots etc. are often required to drive development and such initiatives cannot be motivated by traditional CB analysis.

References:

NEXT-ITS & NEXT-ITS2 evaluation reports, available for download here: https://evaluation.its-platform.eu/EvalLib%20Final%20Corridor%20Reports and https://www.its-platform.eu/filedepot_download/2228/6292?_ga=2.92021466.1327832918.1525430192-697528338.1512643313

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9.4. TP 4: Regulations and other guidance tools as drivers for corridor development

Context and Objective

Key actors in the European mobility market, including providers of transport infrastructure, vehicles and mobility services, are committed to make mobility safer, cleaner, more efficient and more reliable. The starting points of the motivation may differ between public and private actors. However, they ultimately both support a similar set of goals and target the very same group of end users. As it is put in the C-ITS Platform Phase II Report [C-ITS Platform 2017], there is a significant overlap in motivations which provide a sufficient basis to work together towards a shared goal towards the co-creation of the ecosystem.

There are a number of different regulations / tools that support and enable the harmonisation that is required for operation of a multi-stakeholder transport corridor. Standards, legislation, deployment guidelines and contractual requirements are examples. This topic paper will explore different options to harmonisation such as balancing detailed specs and high level, balancing regulatory or voluntary approaches. How efficient are these tools as triggers for development? Do they attract new stakeholders or repel them? An important aspect is that most industrial stakeholders prefer wide perspectives (corridor rather than local) and harmonised solutions. Will this kind of supporting mechanisms then bring in new stakeholders in the development and operation of transport corridors?

Transition dimensions

Market readiness of technology, demand for integrated transport services and policy advancement on core infrastructure networks have been the most important drivers towards a European mobility market. The evolution reveals different dimensions:

- Information and communication technologies in their broadest sense are penetrating all sectors in the economy at all levels. This persisting trend emphasises horizontal layers that link vertical application sectors or industries (cf. AIOTI). It forces actors, for sure also within transport modes, to de-silo their applications.
- As a consequence of the deeper integration of the European Common Single Market, the regulatory interplay between EC and Member States has become more intense and collaborative (e.g. instrument of Delegated Regulations, ITS Directive context).
- The European dimension of mobility has to be underpinned by physical infrastructure networks that provide the capacity for integrated services. The essential role of TEN-T corridors in this context is widely acknowledged, see collection of Issues Papers of European Coordinators [TEN-T 2016]. While infrastructure measures (removing bottlenecks, creating bypasses and interfaces) have a long-term perspective/impact and are well anchored in the

CEF investment priorities, the attractiveness of corridors for integrated services and their visibility bear potential to be enhanced in a more short-to-mid-term perspective.

In summary, the introduced transition dimensions point to more horizontal coherence and more vertical/hierarchical integration. It shows clear elements of a transition towards an ecosystem where different "business" perspectives (i.e. commercial vs. societal) can coexist. When mutual understanding and agreement is achieved, the basis for synchronised investment (geographically, timewise, across sectors) is being laid. What remains is the fundamental issue of how to organise such a process.

Process considerations

When analysing the recent "history" of regulation, it becomes obvious that as an alternative to direct regulation the "threat" of regulation has been posed in order to stimulate voluntary agreement among the addressees of the regulation. This pattern of indirect way of working could also be recognised some years ago in the EU EIP community where EC's ITS Action Plan and Directive has motivated strong efforts towards establishing Deployment Guidelines. Conceptually, framework legislation is answered by self commitment of the addressees.

However, as the experience of the ITS Directive reveals, EC has been effectively able to create a process cycle to collect input and information via different channels and to bring back a set of viable options. The ITS Committee and the Member States Expert meetings are essential elements in this filtering process. It should be also noted that atmospherically there seems to be less polarity and more of a collaborative spirit.

When co-creating an ecosystem, a viable way forward is that a legitimate actor provides a platform where stakeholders can adhere to. The C-ITS Platform can be named as a successful example for sounding the common vision and the recommended steps how to enable C-ITS services in Europe. The recommendations are pursued on a dual channel basis: the one preparing for legal certainty of the implementation framework (C-ITS Delegated Act), the other stimulating a powerful implementation layer (C-Roads as flagship of MS driven C-ITS pilots and deployment initiatives).

Intensified collaboration comes along with technical challenges. They need time to be solved (interfaces to be agreed, taken forward to standardisation etc.) but will be solved. A more persistent challenge is the organisational element of collaboration (roles and responsibilities in multi-actor and multi-sector settings).

Bringing corridors alive from the service perspective can likely piggy back on established fora that drive the development of corridors from the underlying infra perspective. In linking them to services and operation topics, there are still some important steps to go.