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ITS DEPLOYMENT PROGRAMME FRAMEWORK

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Abstract

This deliverable presents a common framework for the CAPITAL deployment programme, outlining the necessary steps to achieve the common goal of raising awareness of the benefits of C-ITS through training and education. The framework targets: transport institutions, decision makers and technicians across three levels of ITS deployment; 1st level ITS start up communities, 2nd level advanced and intermediary communities who have already deployed (C) ITS and 3rd level 'train the trainer' for professional use. Within the framework, training objectives and outcomes for each ITS level are defined, potential topic studies for training modules are identified, a framework for capacity development strategies is presented and performance indicators are developed to measure deployment progress.

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Abbreviations and Acronyms

Acronym	Definition
EC	European Commission
PO	Project officer
GA	Grant Agreement
WP	Work Package
EU	European Union
CAPITAL	**C**ollaborative c**A**pacity **P**rogramme on **I**ts **T**raining-educ**A**tion and **L**iaison
C-ITS	Cooperative Intelligent Transport Systems

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Executive Summary

The CAPITAL coordination support action, will build upon the existing research and development results in the field of Cooperative Intelligent Transport Systems (C-ITS), defined as, "a subset of the overall ITS that communicates and shares information between ITS stations to give advice or facilitate actions with the objective of improving safety, sustainability, efficiency and comfort beyond the scope of stand-alone systems," Horton et al (2016), addressing the gap identified between deployment and research and innovation.

The aim of the CAPITAL project is to design and deliver a collaborative capacity-building programme (comprising of training and further education) for practitioners in the public and private sector in the field of C-ITS deployment. The CAPITAL project will develop an open platform offering training modules, hands-on training in 7 cities and awareness raising and liaison activities focussing on the benefits of C-ITS. The main CAPITAL objectives can be summarised as follows:

- Create a platform of practitioners in the public and private sector in the field of Cooperative ITS deployment by establishing synergies with existing regional, European and international activities
- Identify and assess the capacity needs and knowledge gaps and constraints of the practitioners in the field of Cooperative ITS
- Develop an ITS deployment transferability handbook of case studies (including their respective business models) and support the decision making process for deploying C-ITS
- Design, Implement and assess the collaborative capacity building programme in 7 European cities
- Develop a user awareness strategy and promote dissemination and awareness of the collaborative capacity building programme to other ITS stakeholders

The aim of Work Package (WP) 3 is to provide a common framework for the ITS deployment programme to be implemented in WP4, to provide the study modules and related background information to be used for training purposes, and to support the associated partners with deployment of the systems. In addition, the work package will prepare capacity development strategies for ITS stakeholders.

Further to this report, WP3 will go on to develop study modules for trainers and trainees and produce capacity development strategies for stakeholders with a substantial role in C-ITS deployment. WP3 will form the foundations of WP4 in which the C-ITS deployment programme will be implemented.

This deliverable (D3.1) aims to design a common framework for the CAPITAL deployment programme, outlining the necessary steps to achieve the common goal of raising awareness of the benefits of C-ITS through training and education. The framework targets: transport institutions, decision makers and technicians across three levels of ITS deployment; 1st level ITS start up communities, 2nd level advanced and intermediary communities who have already deployed (C) ITS and 3rd level 'train the trainer' for professional use. Within the framework, training objectives and outcomes for each ITS level are defined, potential topic studies for training modules are identified, a framework for capacity development strategies is presented and performance indicators are developed to measure deployment progress.

The framework, together with contributions from WP2 will inform T3.2 ITS knowledge base of

studies and T3.3 development of training materials, prior to the implementation of the ITS deployment programme in WP4. D3.1 will be a 'living' document throughout the project, indicating that input from tasks in WP2 which are not yet complete can be incorporated at a later stage and performance indicators can be further refined and developed following the completion of T3.3 and the implementation of the Capacity Building programme (T3.4).

1. Introduction

1.1 Background

C-ITS has been placed at the centre of the European Commission (EC) "ITS Action Plan", wherein linking the vehicle with the transport infrastructure is one of four priority areas for development and use of specifications and standards. Alongside this, the EC has recently published their strategy on "Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility" identifying issues to be tackled at European Union (EU) level to ensure coordination of deployment of cooperative ITS (C-ITS) in 2019.

The EC has actively been supporting the development and deployment of C-ITS through its sixth, seventh and H2020 framework programmes. To exploit the results from finalised and ongoing EU projects and start deployment, the importance of raising awareness of the benefits of C-ITS has been highlighted by Member State authorities, Non Government Organisations and industry stakeholders. Through previous research, a gap has been identified; between deployment and research and development, it is pertinent that this is addressed through both awareness raising and the training and education of practitioners, to improve their skills and level of understanding of all aspects of C-ITS deployment.

To address this, the CAPITAL project is aiming to design and deliver a collaborative capacity building programme comprising of training and further education for practitioners in the public and private sector in the field of C-ITS deployment. The overall concept for the project is illustrated in Figure 1. This deliverable will address Phase II Program Design, specifically step 4; Design program objectives, framework and indicators.
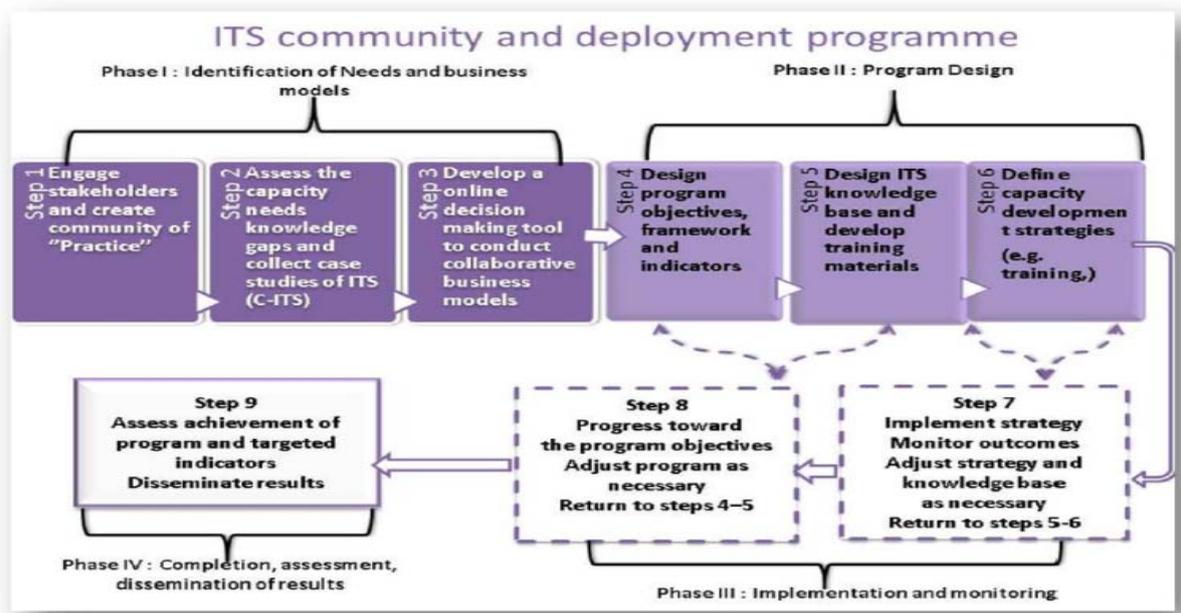

Figure 1 CAPITAL Project Concept

1.2 Objectives of Deliverable

This deliverable 'ITS Deployment Programme Framework' has been developed by UNEW with support from VTT, ERTICO, CERTH and TTS Italia. The objective of the document is to design a common framework for the CAPITAL deployment programme, targeting: transport institutions, decision makers and technicians across 1st level ITS start up communities, 2nd level advanced and intermediary communities who have already deployed ITS and 3rd level 'train the trainer' for professional use.

1.3 Structure of the Deliverable

This deliverable is structured as follows:

- Chapter 2 presents the objectives of the ITS Deployment Programme Framework, defines the three different levels of ITS deployment together with the expected learning objectives and outcomes for each level of ITS deployment
- Chapter 3 identifies the topic studies
- Chapter 4 proposes a framework for identification of capacity development strategies
- Chapter 5 develops performance indicators to monitor deployment progress

2. ITS Deployment Programme Framework Objectives and Learning Outcomes

2.1 Framework objectives

A common framework for the CAPITAL deployment programme is an important tool, which will outline the steps necessary to achieve the common goal of raising awareness of the benefits of C-ITS through training and education.

The objectives of the framework are:

- To develop a set of guidelines and procedures to be applied during the CAPITAL deployment programme implementation and monitoring
- To ensure that the CAPITAL deployment programme can be adjusted to facilitate the needs and requirements of each stakeholder
- To make sure that CAPITAL deployment programme is in line with the European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility

It is possible to identify three stakeholder groups relevant for deployment and adoption of ITS technologies: users, vehicle and system manufacturers and authorities and administrations (Bekiaris et al. 2004).

Typically, public authorities aim to achieve a defined set of political objectives and perform their tasks in an optimum way, while private businesses can be assumed to maximise their profit and to advance the strategic goals related to their businesses. The decision-making problem related to ITS is therefore different for different stakeholders. The requirements for information and knowledge are also different for different stakeholder groups.

The monitoring of ITS deployment in the iMobility Support project (Öörni 2016) indicated that there is substantial variation between EU member states in the deployment status of in-vehicle and infrastructure based ITS systems (e.g. dynamic traffic management or real-time traffic information). While some member states have a long history and substantial experience of ITS deployment, there are also member states with very limited or no ITS services (e.g. real-time traffic information via RDS-TMC or DAB, e-Call or dynamic traffic management systems).

2.2 1st Level ITS Deployment Objectives and Learning Outcomes

The first level of ITS deployment are ITS start-up communities. These stakeholders and their staff

have very limited or no experience in deployment of traditional ITS and no experience with research or deployment of cooperative ITS (C-ITS). Examples of these include public sector decision-makers in member states with very few or no dynamic traffic management systems and very limited or no real-time traffic information services. The group of first level stakeholders also includes mid-sized cities with no urban ITS measures (except traffic lights) and businesses operating in transport, telecommunications or software industries with very little or no experience with ITS technologies or ITS products.

For stakeholders and staff at level 1, the main question is, "what is ITS/C-ITS and why is it relevant for me"

For stakeholders and staff at level 1, the CAPITAL project will provide training in:
- An introduction to ITS
- Existing legal framework on ITS/C-ITS at National and European level
- Basic information on relevant ITS applications which allows the stakeholder to consider and start planning ITS deployment
- Sources for further information on ITS and best practices in ITS deployment
- Contacts with stakeholders which have already marketed or implemented ITS systems.
- Information on ITS funds at national and European level
- Quick/basic example on potential barriers linked to ITS implementation

The learning outcomes proposed for level 1 training participants include:
- The definition of ITS, history of ITS technologies, connections of ITS to other sciences
- Most important ITS applications (e.g. proven and widely deployed systems and systems identified as a priority in EU)
- Impacts of ITS applications (safety, environmental, traffic efficiency and mobility impacts, impacts for communities at social, economic and environmental level)
- Relevance of ITS applications and their impacts to policy objectives (e.g. transport policy and policy on information society)
- Main political initiatives related to ITS in Europe, deployment status of selected systems
- Definition of cooperative ITS
- Examples of C-ITS applications (how C-ITS applications work, e.g. ETSI Basic Set of Applications)
- Awareness improvement on barriers and deployment

2.3   2nd Level ITS Deployment Objectives and Learning Outcomes

The second level of ITS deployment are communities who have already deployed ITS and have gained some experience or familiarity with different systems. Stakeholders in level two include member states with some experience in ITS deployment, cities with at least some urban ITS systems (e.g. dynamic traffic management or public transit priority) and businesses which have at least minimum level of familiarity with ITS technologies and the ITS market.

For stakeholders and their staff at level 2, the main question is, "how can I use ITS/C-ITS technologies in an optimum way and which actions should be taken to realise the potential of ITS/C-ITS?"

For stakeholders and staff on level 2, the CAPITAL project will provide training in:

- Capability to identify relevant ITS applications, understand their implementation issues and analyse their impacts, benefits, costs and relevancy to policy objectives
- Information on current research and theoretical issues related to ITS

- Lessons learned and best practices at national and international level in (Cooperative) ITS deployment
- Barriers in (Cooperative) ITS implementation
- Contacts with stakeholders on advanced level in ITS deployment

The learning outcomes proposed for level 2 training participants include:
- Taxonomy of ITS systems and technologies, including C-ITS
- Understanding of ITS impact assessment methods
- Use of cost-benefit analysis in ITS implementation
- Development of an ITS strategy and ITS architecture
- Impacts and costs of ITS and C-ITS, sources for further information on impacts and cost data
- ITS and C-ITS implementation issues
- Case studies on ITS/C-ITS deployment
- Awareness on how to overcome ITS implementation barriers

Other expected outcomes of training:
- Improved consensus and teamwork
- Building of fostered communities

The training will be focused on expertise and support level 2 training participants with implementation and strategic planning issues.

2.4   3rd Level ITS Deployment Objectives and Learning Outcomes

The third level of the ITS deployment levels are stakeholders and staff with extensive experience in ITS/C-ITS deployment or research and development of ITS/C-ITS technologies. The focus of the training is to 'train the trainer' for professional and to create future trainers of C-ITS/ITS. Stakeholders and experts on the third level either have trained others in ITS/C-ITS topics or have the potential to develop such capability.
For stakeholders and staff on level 3, the main question is, "what should I advise or encourage others to do in regards to ITS/C-ITS?" In practice, this means getting trainees to study ITS/C-ITS technologies and apply them in an optimum way.

For stakeholders and staff at level 3, the CAPITAL project will provide training in:

- Capability to identify relevant ITS/C-ITS applications, understand their implementation issues and analyse their impacts, benefits, costs and relevancy to policy objectives
- Theoretical background on core issues related to ITS/C-ITS
- Status of ITS/C-ITS deployment in Europe, including case studies
- Capability to act as future trainers on ITS/C-ITS
- Capability to identify and focus on ITS/C-ITS benefits and relevant KPI

Following training of level 3 participants, the expected learning outcomes include:
- Taxonomy of ITS systems and technologies, including C-ITS
- Communication technologies for C-ITS
- ITS/C-ITS standardisation
- Impacts and costs of ITS and C-ITS
- ITS/C-ITS implementation issues, including solutions to implementation issues
- Ongoing policy initiatives in ITS/C-ITS deployment (including implementation status in

Europe)
- Active research topics in ITS/C-ITS
- Awareness on ITS/C-ITS benefits and KPI

3. Identification of Topic Studies

In this chapter, we present the outline of topic studies to be tailored to each level; these will feed into T3.2 knowledge base and the development of training material in T3.3. The topic studies will mainly cover C-ITS, however ITS in general will also be included as background information.

Potential topic studies are included below;

- Introduction to ITS and C-ITS
- Evaluation of ITS and C-ITS, including Cost Benefit Analyses of ITS services
- Financial incentives, business models and procurement models for C-ITS deployment
- Communication technologies for ITS (and C-ITS) and relevant standards
- Guidance in Deploying ITS (C-ITS), including deployment and implementation strategies, roadmaps and international best practices
- Implementation issues of ITS and C-ITS: data collection, security and privacy, user acceptance, institutional and organizational issues
- TMC and roadside technologies for C-ITS
- ITS and C-ITS user services
- Standards, architectures and communication technologies for ITS and C-ITS standards
- ITS and C-ITS policy frameworks
- Engagement of public and private stakeholders - communicating ITS and C-ITS to the public

The final topic studies will be defined once the results from the questionnaire regarding the capacity needs and knowledge gaps in T2.2 are available. The studies will cover the same topics for the three different levels of ITS deployment, but the content will be more detailed the higher the level is. The topic studies will designed and completed as independent "books" or leaflets available to the participants of the training.

4. Framework for Capacity development strategies' identification

According to the United Nations, "Capacity development (or Capacity building) is the process through which individuals, groups, organisations and societies deploy, adapt, strengthen, and maintain the capabilities to define, plan and achieve their own development objectives on an inclusive, participatory, and sustainable basis" (United Nations, 2009). Therefore capacity development is a conceptual approach to personal or group skills development with a focus on the one hand to identify existing barriers in achieving specific development goals and on the other to enhance the capabilities of individuals and/or groups for successful deployment of these specific goals.

The capacity development process already identified by the United Nations (United Nations, 2009) includes five distinctive steps which feed one another. These steps are:

1. Engage stakeholders on Capacity development
2. Assess capacity assets and needs
3. Formulate a capacity development response
4. Implement a capacity development response
5. Evaluate capacity development

The steps follow a linear concept. However, step 5 can feed step 1 and create an additional round of the process with a view to optimize the results of the capacity development implementation.

In recent years the Capacity development concept has evolved from a more traditional approach of just training and technical abilities enhancement, to a more integrated approach of interactive skills development between the trainers and the target groups. Therefore conventional approaches such as "Gap analysis and needs assessment" have been modified into "understanding of existing assets to build on".

For the case of the CAPITAL project and taking into account the 3 levels of ITS deployment communities as described in chapter 2, it becomes obvious that different strategies should be shaped and implemented to different stakeholders groups of the different levels of ITS deployment communities. Therefore for each level of community 3 strategies will be developed for the three stakeholders groups. The following list includes the targeted groups for each strategy:

1. Authorities and administrators of the 1st level of ITS deployment communities
2. Vehicle and systems manufacturers of the 1st level of ITS deployment communities
3. Users of the 1st level of ITS deployment communities
4. Authorities and administrators of the 2nd level of ITS deployment communities
5. Vehicle and systems manufacturers of the 2nd level of ITS deployment communities
6. Users of the 2nd level of ITS deployment communities
7. Authorities and administrators of the 3rd level of ITS deployment communities
8. Vehicle and systems manufacturers of the 3rd level of ITS deployment communities
9. Users of the 3rd level of ITS deployment communities

The procedure for developing the strategies will be based on the capacity and knowledge gaps which are expected to be identified within WP2, the information available from other tasks of WP3, the results available in open literature (e.g. conference papers and presentations) and the knowledge and experience inside the consortium. The recommended capacity development strategies will be

validated with a survey / stakeholder feedback after the training programmes and possible adjustments will be implemented.

5. Evaluation and Monitoring of the ITS deployment programme

5.1 Evaluation and monitoring, introduction and aims

Following the execution of the CAPITAL training programme, it is critical to implement performance indicators to monitor and evaluate progress. Indicators will be specific to each of the three levels and each of the target groups.

Performance indicators are regularly employed during performance assessment across a number of sectors and can be defined as a tool to measure and evaluate the performance of any given process. Indicators will identify gaps and highlight areas for improvement in the deployment programme, which will feedback into programme delivery meaning that it can be adapted and improved if necessary. Indicators should reflect the learning outcomes for each of the target groups who will utilise the deployment programme. As the ITS Deployment Programme Framework will be a 'live' document throughout the project, indicators will be proposed which can be further refined and developed following the development of educational material (T3.3) and the implementation of the Capacity Building programme (T3.4).

Training Programme Indicators aim to:

- Ensure that training participants achieve the learning outcomes defined
- Verify that the participants have gained a high level of benefit from the training
- Confirm that the training is targeted at the correct level by collecting feedback which can input back into the programme design.
- Continue to monitor training participants, subsequent to pilot training

5.2 Performance Indicators to monitor progress of the CAPITAL ITS deployment programme.

Table 1 outlines the proposed approach to monitor the progress of the CAPITAL ITS training programme. This will include assessing the attainment of learning objectives (as defined in chapter 2) for each level of ITS, obtaining an understanding of the level of benefit gained by participants undertaking the training, understanding whether the training is targeted at the correct level for each ITS community. For training carried out subsequent to the pilot programme, indicators are proposed to collect information about the ongoing influence of the training programme.

Table 1- Performance Indicators CAPITAL ITS Deployment Programme

Aim	Indicator	Target Group	Details
Ensure that training participants achieve the learning outcomes as set out in chapter 2	Assessment- Assessing the level of competence of training participants, tested through a short online test or a written paper	All- technicians, decision makers, transport institutions	Collaboration with WP2 will provide information on the different assessment methods which will be most suitable for each target group.

			Feedback forms and assessment materials will be developed during T3.3.
Verify that the participants have gained a high level of benefit from the training	Detailed survey Carried out with selected participants from each training workshop, which includes participants from a range of ITS levels and all target groups	All- technicians, decision makers, transport institutions	Developed in T3.3 the detailed survey will aim to gain an understanding of which aspects of the training were of most use to the participants. This information can be used to refine the training.
Confirm that the training is targeted at the correct level by collecting feedback which can input back into the programme design.	Feedback form Including questions which target the relevance of the training session- with responses measured on a numerical scale.	All- technicians, decision makers, transport institutions	Feedback surveys developed during T3.3 will be carried out post training session. WP2 will provide input regarding preferred learning style and assessment method for each ITS level and target group.
Continue to monitor training participants, subsequent to pilot training	Data collection	All- technicians, decision makers, transport institutions	Register the number of users accessing the online delivery platform following the training workshop Record the number of instances of secondary training of key training personnel.

6. Summary and Next Steps

The CAPITAL project aims to design and deliver a collaborative capacity-building programme (comprising of training and further education) for practitioners in the public and private sector in the field of Cooperative ITS deployment.

This Deliverable (D3.1) ITS deployment programme framework sets out a common framework for the CAPITAL deployment programme, documenting the necessary steps to achieve the common goal of raising awareness of the benefits of CITS through training and education.

Training will target both practitioners in the public and private sector and stakeholders from; decision makers, technicians and transport institutions. Specific learning objectives and outcomes have been defined for each of the three levels of ITS deployment; 1st level ITS start up communities, 2nd level advanced and intermediary communities who have already deployed ITS and 3rd level 'train the trainer' for professional use as detailed in chapter 2.

Potential topic studies to be incorporated into the training modules have been presented in chapter 3; these will be further developed in T3.2 and T3.3. A framework to identify capacity development strategies was proposed in chapter 4; this incorporates a procedure for capacity development strategy design, together with the identification of targeted groups for each strategy, T3.4 will expand on this. Performance indicators to monitor the progress of the training implementation have been outlined in Chapter 5 these include assessing the attainment of learning objectives, understanding the level of benefit gained by training participants and understanding whether the training is targeted at the correct level for each ITS community which will feedback directly into programme delivery.

This deliverable, together with contributions from WP2 will inform T3.2 ITS knowledge base of studies and T3.3 Development of training materials, prior to the implementation of the ITS deployment programme in WP4. D3.1 will be a 'living' document throughout the project, meaning that input from tasks in WP2 which are not yet complete can be incorporated at a later stage and performance indicators can be further refined and developed following the completion of T3.3 and the implementation of the Capacity Building programme (T3.4).

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