COST
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

DECISION

Subject: **Memorandum of Understanding for the implementation of the COST Action "Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport" (WISE-ACT) CA16222**

The COST Member Countries and/or the COST Cooperating State will find attached the Memorandum of Understanding for the COST Action Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport approved by the Committee of Senior Officials through written procedure on 23 June 2017.

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MEMORANDUM OF UNDERSTANDING

For the implementation of a COST Action designated as

COST Action CA16222
WIDER IMPACTS AND SCENARIO EVALUATION OF AUTONOMOUS AND CONNECTED TRANSPORT (WISE-ACT)

The COST Member Countries and/or the COST Cooperating State, accepting the present Memorandum of Understanding (MoU) wish to undertake joint activities of mutual interest and declare their common intention to participate in the COST Action (the Action), referred to above and described in the Technical Annex of this MoU.

The Action will be carried out in accordance with the set of COST Implementation Rules approved by the Committee of Senior Officials (CSO), or any new document amending or replacing them:
   a. "Rules for Participation in and Implementation of COST Activities" (COST 132/14);
   b. "COST Action Proposal Submission, Evaluation, Selection and Approval" (COST 133/14);
   c. "COST Action Management, Monitoring and Final Assessment" (COST 134/14);
   d. "COST International Cooperation and Specific Organisations Participation" (COST 135/14).

The main aim and objective of the Action is to Which are the wider impacts of Autonomous and Connected Transport and how can they be evaluated?. This will be achieved through the specific objectives detailed in the Technical Annex.

The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 88 million in 2016.

The MoU will enter into force once at least five (5) COST Member Countries and/or COST Cooperating State have accepted it, and the corresponding Management Committee Members have been appointed, as described in the CSO Decision COST 134/14.

The COST Action will start from the date of the first Management Committee meeting and shall be implemented for a period of four (4) years, unless an extension is approved by the CSO following the procedure described in the CSO Decision COST 134/14.

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OVERVIEW

Summary

Autonomous vehicle (AV) trials are currently taking place worldwide and Europe has a key role in the development of relevant technology. Yet, very limited research exists regarding the wider implications of the deployment of such vehicles on existing road infrastructure, since it is unclear if and when the transition period will start and conclude.

It is anticipated that improved accessibility and road safety will constitute the primary benefits of the widespread use of AVs, whilst co□benefits may also include reduced energy consumption, improved air quality or better use of urban space. Therefore, the focus of this COST Action is on observed and anticipated future mobility trends and implications on travel behaviour, namely car sharing, travel time use or residential location choice to name a few. Other important issues to be explored under different deployment scenarios are social, ethical, institutional and business impacts.

To achieve this, it is essential to culminate co□operation between a wide range of stakeholders at a local, national and international level, including academics and practitioners. Consequently, this COST Action will facilitate collaboration within Europe and beyond about this emerging topic of global interest.

Areas of Expertise Relevant for the Action	Keywords
● Social and economic geography: Transport planning and socio-economic aspects of mobility, transport and logistics ● Media and communications: Media and communications, social aspects of information science and surveillance, socio-cultural communication ● Computer and Information Sciences: Ethics of computer and information sciences ● Civil engineering: Transport engineering ● Economics and business: Management of Technology and Innovation	● autonomous vehicles ● connected transport ● driverless ● wider impacts ● scenario development and evaluation

Specific Objectives

To achieve the main objective described in this MoU, the following specific objectives shall be accomplished:

Research Coordination
● Develop common terminology about ACT across Europe which will be facilitated through an online glossary. It is observed that language and culture across countries and industries play a vital role in understanding key transport notions, so it is useful to develop and use such a glossary to establish common vocabulary.
● Co-ordinate trials and share know-how across diverse localities to highlight best practice in Europe and beyond . Given that a series of AV trials will take place during the forthcoming years, it is important to coordinate activities and generate comparable outputs based on common research design features.
● Compare simulation results and end user preferences from diverse settings to develop plausible scenarios for ACT deployment. This objective requires deep knowledge of the demand and supply sides of transport networks. Use values from diverse trials in simulations are needed to contrast findings and progress from corridor-based to network-based planning.
● Agree on a roadmap about the wider impacts of ACT deployment to inform policy makers and regulators about the current and future requirements regarding the formulation of relevant standards. Outputs will align diverse policy targets and may be also used by the automotive industry or local authorities hosting ACT trials.
● Identify and evaluate viable business models for the passenger and freight transport industry. This will

include collaboration with local and national authorities to identify value creation activities including those linked with privacy and data management. It will be of value to both the public and private sectors.

● Assess user acceptability and inform the general public and key stakeholders about the opportunities and risks of ACT. This will facilitate formal and informal debates to take place and can increase acceptability of ACT.

Capacity Building

● Build a community fostering scientific dialogue, knowledge exchange and the development of a consolidated thematic framework about the wider impacts of ACT by experts from multiple disciplines and ITCs. Success will be measured by the number of members and disciplines included in the community at the end of the Action.

● Support ECIs, while promoting gender balance, through a multidisciplinary training programme focusing on the enhancement of methodological, analytical, communication and research portfolio building skills. This will be measured by the number of ECIs (and male/female ratio) participating in training schools and STSMs of this Action, including relevant scientific outputs produced.

● Bridge distinct scientific fields (e.g. legal informatics with transport economics and engineering) through STSMs to achieve a breakthrough in the development of appropriate standards and regulations for ACT which requires an interdisciplinary approach. This will be measured by the number of STSMs which generated input for the White Paper.

● Act as a transnational stakeholder platform which will provide evidence based recommendations to academics, practitioners and policy makers about the deployment of ACT. This will be measured by the output documents' downloads requested through the Action website.

1) S&T EXCELLENCE

A) CHALLENGE

I) DESCRIPTION OF THE CHALLENGE (MAIN AIM)

Ongoing vehicle trials globally are testing hands off car travel, driverless taxis, goods delivered by self-driven trucks and buses with no steering wheel, making this era a tipping point in history. Movement of people and goods has undergone a series of revolutions from walking to using animals and to the fossil fuel based internal combustion engine used nowadays since the 19th century. The next mobility revolution is underway based on a combination of self-driven vehicles and Information and Communication Technology (ICT) generated data streams. The latter has been labelled as Autonomous and Connected Transport (ACT) and is undoubtedly one of the most interesting and complex disruptions of the 21st century.

Early reports estimate immense potential benefits by the widespread deployment of autonomous vehicles (AVs) e.g. transport cost reduction exceeding US$1 trillion and CO_2 emissions reduction over 1 Gt (RMI, 2016) which would be equivalent to 75% of the US transport GDP (Gross Domestic Product) or 8% of the overall US GDP. On a global basis, this would mean global annual savings of US$5.6 trillion (Morgan Stanley, 2013). The primary benefit of ACT as put forward by the automotive industry and increasingly by policy makers are the potential safety benefits. Statistics from the US and the UK demonstrate that 94% of accidents are attributed to drivers (NHTSA, 2015; Wadud and Anable, 2016), so eliminating human control of vehicles could reduce accidents proportionally. This would be an ideal outcome since more than 1.2 million people are killed annually by road traffic injuries (WHO,2016). As a result, one would argue that immediate action should be taken to deploy AVs (Autonomous Vehicles) given these estimates.

In addition, ACT has allowed new stakeholders such as ICT firms to enter the automotive industry (e.g. Apple, Google) which opens up opportunities for European businesses too. The need of location and traffic sensors as well as additional communication operations (V2I – Vehicle to Infrastructure, V2V – Vehicle to Vehicle) create potential synergies both for SMEs (Small and Medium Enterprises) and the four established European automotive manufacturers featuring in the top ten largest manufacturers globally. Yet, despite the optimism stemming from the latest technological advances, a cautious approach has been suggested by scholars and Civil Society Organisations (CSOs) recently regardingthe deployment of AVs. Questions have arisen about the sufficient level of additional safety offered by ACT (e.g. twice as good as today or ten times better?) based on a study which did not find lower crash rates of AVs compared to conventional vehicles (Schoettle and Sivak, 2015). Such queries have led to the suggestion of adaptive regulation which will evolve alongside the advancement of ACT (Kalra and Paddock, 2016).

Such regulations will need to accommodate a wide range of issues intertwined with the deployment of ACT, namely institutional and societal issues aside the expected transport

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and technological ones, which include car sharing, travel time use or land use planning to name a few. Consequently, there appears to be an urgent need to identify and evaluate the wider impacts of automated and connected transport, since this is a step change development which will have long-lasting implications. The main aim of this proposal is to address the followingchallenge: **Which are the wider impacts of Autonomous and Connected Transport and how can they be evaluated?**

By focusing on ACT, this Action will highlight and aid in unravelling the significant challenges arriving with the deployment of AVs. The main aim encompasses further secondary challenges which are outlined here:

1. **Institutional**: What are the institutional challenges posed by the widespread deployment of AVs? This includes macro-economic, fiscal and ethical challenges, as well as reviewing options for the role of the local and national governments.
2. **Societal**: How can governments ensure that ACT will not exacerbate the digital divide and instead increase accessibility and transport equity? Aligning ACT with wider existing policies is a crucial requirement and this is an identified gap currently.
3. **Business**: How can business benefits through ACT be augmented and dispersed across diverse stakeholders and geographies? Ensuring that benefits are diffused locally, nationally and internationally taking into account employment implications is a key objective of European policy, thus it is an important aim.
4. **Transport**: How will ACT co-benefits influence transport appraisal practice? This includes travel behaviour and travel time.
5. **Scenarios**: Which are the key scenarios required to assist the deployment of ACTacross diverse European localities with diverse transport and ICT infrastructure?

A proactive multidisciplinary approach towards a unified framework is required to evaluate this emerging mobility system and its wider impacts across Europe. To devise such a framework it is essential to culminate co-operation between a critical mass of stakeholders at a local, national and international level, including academics, practitioners, policy makers and the wider public. Consequently, this Action aims at strengthening existing research and innovation capacity by facilitating collaboration within Europe and beyond about this emerging topic of global interest.

II) RELEVANCE AND TIMELINESS

The EC (2011) White Paper established the foundations for the Single European Transport Area through 40 concrete initiatives which aim at reducing car use and eliminating them completely from cities by 2050, whilst meeting the GHG targets as set out in the Paris Climate Action Agreement(2015). It is therefore timely to evaluate how ACT can aid shaping carless cities and redefine the role of public transport as tested for example in Finland (Whim), given that two thirds of global population is projected by the UN to live in cities by 2050.

In 2014,the C-ITS Deployment Platform was conceived to support thedeployment of automated and connected vehicles, which was sealed with the endorsement of the first phase report in early 2016 whereas the second report is planned to be released before the end of2017. The Cost-Benefit Analysis (CBA) and scenario analysis in the first report demonstratedthat positive business and social impacts will materialise during 2022-2026 depending on deployment and adoption rates. Although this report has a wider focus, it is indicative of the wider challenges (e.g. higher local needs in infrastructure updates compared to lower needs at EU level) and the pressing need for international collaboration across Europe and beyond regarding the deployment of ITS and AVs in particular.

Moreover, the Declaration of Amsterdam (14th April 2016) which was signed by all EU-28 members underlined the need for the common objectives for connected and automated transport to: reduce environmental and health impacts, foster cross-border collaboration to strengthen the position of European industry, address privacy and data management concerns and issue a coherent pan-European framework before 2020 if possible. At the same time, thisdocument invites the European Commission, member states and industry to collaborate and exchange information, particularly through trials and pilot testing. This means that evidence from trials in urban areas such as the first AV trial in the UK (Milton Keynes) or the first autonomous public transport trial in The Netherlands (Wageningen) during 2016, as well as the DriveMe trial which will be launched in Sweden (Gothenburg) during 2017 should be supported. Equally, freight transport trials such as the 2016 European Truck Platooning Challenge which sawtruckmanufacturers send self-driven trucks to Rotterdam from different European countries should also be enhanced.

Nevertheless, all trials are currently based on the road traffic rules set out by the 1968 Vienna Convention which can accommodate trials up to automation level 4, but not level 5 (full automation i.e. autonomous transport) which has been under review by UNECE-WP1 in 2016. Additionally, certain countries both within Europe (e.g. Austria, The Netherlands) and outside Europe (Australia, New Zealand, US) are currently developing legal frameworks allowing testing of AVs on their road networks. However, it is noteworthy that user and wider public engagement is absent at this vital developmental stage. Local authorities and academics have not yet turned their attention to the broader mobility and socio-economic issues that ACT introduces. Thus, given that during the past decade there has already been a lot of attention to the existing and future technological advancements of vehicles (including V2V and V2I), it is hightime to focus on the wider issues surrounding the deployment of ACT. The latter is essential to enable the development of breakthrough concepts about ACT since key design and data sharing decisions taken today will influence future social and urban developments. As a result, this Action is timely and relevant to the existing and future policy needs, aiming at bridging the knowledge sharing gap between academia, industry and policy.

B) SPECIFIC OBJECTIVES

I) RESEARCH COORDINATION OBJECTIVES

The Research Coordination Objectives to be met during this Action are to:

RO1 – Develop common terminology about ACT across Europe which will be facilitated through an online glossary. It has been observed that language and culture across countries and industries play a vital role in understanding key transport notions, so it is useful to develop and use such a glossary to establish common vocabulary.

RO2 – Coordinate trials and share know-how across diverse localities (megacity, mediumsized city, small city) to highlight best practice in Europe and beyond (e.g. Australia, Brazil, Canada, US). Given that a series of AV trials will take place during the forthcoming years, it is important to coordinate activities and generate comparable outputs based on common research design features.

RO3 – Compare simulation results and end user preferences from diverse settings (megacity, medium sized city, small city) to develop plausible scenarios for ACT deployment. This is an important objective which requires deep knowledge and understanding of the demand and supply sides of transport networks. It will be useful to use values from diverse trials in simulations and contrast findings to progress from corridor-based to network-based planning.

RO4 – Agree on a roadmap about the wider impacts of ACT deployment which will inform policy makers and regulators about the current and future requirements regarding the formulation of relevant standards. This output will align diverse policy targets and may be also used by the automotive industry or local authorities hosting ACT trials.

RO5 – Identify and evaluate viable business models for the passenger and freight transport industry. This will include collaboration with local and national authorities to identify value creation activities including those linked with privacy and data management. It will be of value to both the public and private sectors.

RO6 – Assess user acceptability and inform the general public (in at least three COST countries) and key stakeholders (road transport authority, local authority, Civil Society Organisation) about the opportunities and risks of ACT. This will facilitate formal and informal debates to take place and can increase acceptability of ACT.

II) CAPACITY-BUILDING OBJECTIVES

The Capacity-building Objectives to be met during this Action are to:

CO1 – Build a community fostering scientific dialogue, knowledge exchange and the development of a consolidated thematic framework about the wider impacts of ACT by experts from multiple disciplines (e.g. transport, logistics, civil/electrical engineering, economics, business, innovation management, software development, media communications, architecture, urban planning, law), focusing particularly on participants from ITCs to increase their capacity.This will be measured by the number of members and disciplines included in the online community at the end of the Action.

CO2 – Support ECIs, while promoting gender balance, through a multidisciplinary training programme focusing on the enhancement of their methodological, analytical, communication and research portfolio building skills, thereby strengthening the future European Research Area. This will be measured by the number of ECIs (and male/female ratio) who took part in training schools and STSMs of this Action, including any relevant scientific outputs produced.

CO3 – Bridge distinct scientific fields (e.g. legal informatics with transport economics and engineering) through STSMs to achieve a breakthrough in the development of appropriate standards and regulations for ACT which requires an interdisciplinary approach. This will be measured by the number of STSMs which generated input for the White Paper.

CO4 – Act as a transnational stakeholder platform which will provide evidence basedrecommendations to academics, practitioners and policy makers about the deployment of ACT. This will be measured by the output documents' downloads requested through the Action website.

C) PROGRESS BEYOND THE STATE-OF-THE-ART AND INNOVATION POTENTIAL

I) DESCRIPTION OF THE STATE-OF-THE-ART

A range of megatrends have been identified at the core of the emerging global trends to 2050, including urbanization, population growth, inter/intra-national social disparities, demographic change, climate change and ethics (Hoppe et al, 2014). Transport is embedded in this changing world since it constitutes an important sector when considering low carbon targets which are high in the policy agenda after the ratification of the Paris Agreement (2015) by 197 countries which entered into force in November 2016. Within this broader context, ACT has a key role to play since it has been described as a game changer which

can introduce major social impacts e.g. travel time reduction, crash savings, fuel efficiency, parking benefits. While quantifying these positive impacts, benefits have been estimated between $2000 - $5000 annually per autonomous vehicle (Fagnant and Kockelman, 2015; Gao et al, 2016; Litman, 2016). From a macroeconomic perspective, benefits could be substantial too since researchers have estimated that 100% adoption of shared autonomous vehicles can reduce the urban car fleet by 83% when high capacity public transport systems are present and equally reduce the urban taxi fleet by 90% (ITF, 2015).

Having seen the 2016 releases by Tesla including a self-driven passenger car and by Ottomotto LLC (currently owned by Uber) including autonomous logistics operations, it is safe to assume that Level 4 automation (full automation according to the US NHTSA – National Highway Traffic Safety Administration) technology is available, despite being naturally not flawless. Academics and practitionerscurrently debate the timescale and ACT adoption scenarios. Figure 1 indicates that 2025 could be the turning point when fully autonomous cars will be purchased by the general public. Forecasting the actual year when fully autonomous vehicles will be released is of course challenging, but it demonstrates the urgent need to consider the wider issues surrounding such a development.
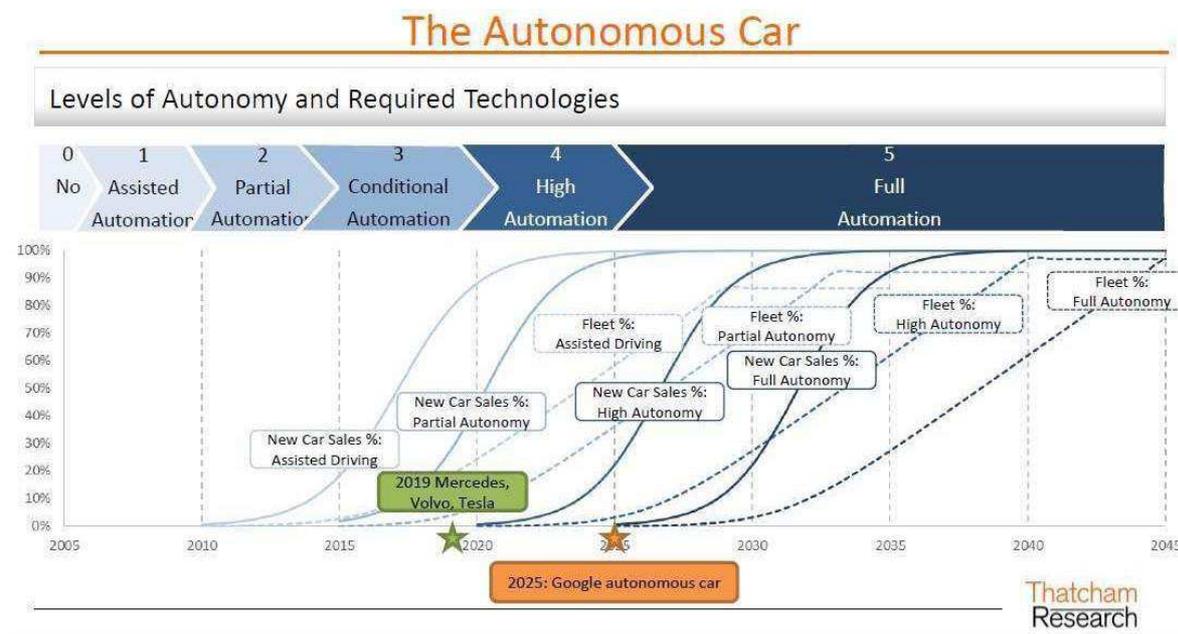

Figure1:Automation levels and ACT adoption scenarios(A.Miller, 2015)

Nevertheless, another trend has been observed in major cities around the world, the so called 'peak car'. Car ownership has been stabilising in the EU since 2000 and even decreasing in the US, whereas it has been growing considerably in China and India (World Bank, 2014). Similarly, car license rates have been dropping in large cities of developed countries, indicating a change in urban transport trends between developing and developed countries. Following the 'peak car' theory, Goodwin and van Dender (2013) argue for the need to develop several alternative scenarios about car use of those who will be middle-aged during the period 2025-2050. A subsequent question is whether car use will alter in the future and whether the availability of ACT will introduce shared car travelling, eventually leading to the reduction of the private car as currently known.

Researchers in The Netherlands have developed four scenarios (In standby, In bloom, In demand, In doubt) to review such impacts and inform national policy (Milakis et al, 2015). Along the same lines, Alessandrini et al (2015) have investigated alternative cyber-mobility scenarios in selected European cities, with a particular focus on autonomous public

transport. This is of high importance since there is a risk of reinforcing car use through ACT on the expense of public transport which is a more efficient means of transport in urban areas (Thomopoulos and Givoni,2015). The latter point underlines the interrelationship between transport planning and urban form (Newman and Kenworthy, 2011; Rode et al, 2017) since improved accessibility for all citizens (e.g. elderly, vulnerable travellers) will be the future challenge due to high urbanisation. Since it is anticipated that ACT will be launched in cities, researchers and practitioners have started evaluating business impacts too. The ACT market for the first 26 US cities to launch such initiatives by2025 has been estimated to US$120bn which constitutes 10% of the total US mobility marketand its annual growth rate will range between 3% and 11% (RMI, 2016). Therefore, the deployment of ACT can be commercially viable.

Although it is impossible to predict all future implications and additional impacts may emerge following the deployment of autonomous vehicles, social scientists have identified the majority of key issues related with the wide deployment of ACT, thus aligning social research with the advanced technological developments. However, as the example of Masdar city has pointed out, there is a range of key non-technological issues which are still under-investigated, for example due to diverse national policies and regulations or due to the closed silos of the automotive industry. Fagnant and Kockelman (2015) urge attention to be turned to:

- Future market AV penetration rates
- Travel and land use pattern evolution
- Developing inter/national regulations for ACT
- Determining standards for safety, security, liability, privacy

II) PROGRESS BEYOND THE STATE-OF-THE-ART

As stated in the previous section, there exists a lot of active and passive interest globally about this challenge which is for example demonstrated in the number and diversity of scenarios being developed. In addition, the European Parliament highlighted the need to focus on the transition and deployment of ACT (EuroParl, 2016). Consequently, this Action aims at progressing beyond the current state-of-the-art by focusing on the deployment issues identified by several researchers and practitioners, as summarised e.g. by Fagnant and Kockelman (2015) in section1.C.I. This Action will review the request to develop scenarios linked with adaptive standards and regulations (Rohr et al, 2016), in contrast to the view of developing less flexible regulatory frameworks by governments and international institutions, thus contributing in relevant regulatory debates.

One of the key weaknesses of current research is that it focuses on specific corridors or urban areas without wider synergies. Sharing information across cities, countries and stakeholders is of utmost importance at this stage of development to ensure economic efficiency. Naturally, the automotive industry protects and does not share information about ongoing development. However, a positive change occurred in November 2016 when Apple stated that it would be of wider benefit if those involved in the development and deployment of ACT shared unidentifiable data. This statement implies that if urged by a national authority or an international standards organisation, private companies may be willing to share certain types of information. Moreover, this statement stresses that transport is no more solely a hardware industry (i.e. conventional automotive industry), but also a software one (e.g. including ICT firms such as Apple or Google).

An interrelated challenge is data management and privacy. No consensus exists currently among academics, practitioners and regulators, revealing that those issues have to be explored in more depth, otherwise the whole "business could be derailed" (Anderson et al, 2016). Additionally, liability in case of an accident and whether travellers would board AVs programmed to sacrifice certain individuals instead of others remain unresolved matters

(Bonnafon et al,2016). New legislation in Florida states that liability remains with the party who installed theautonomous technology in the vehicle (McCandless, 2015) raising issues of ethics and equity. Hence, this Action will utilise findings of previous and ongoing European (e.g. CARTRE, CityMobil2, MAVEN, OPTIMISM) and international research projects to aid in addressing these bottlenecks.

Consequently, this Action aims at progressing beyond the state-of-the-art through the following:

- Contrast diverse scenarios testing both adaptive and non-adaptive ACT regulations
- Share information about the development of effective ACT standards
- Classify challenges linked with equity, liability, privacy and data management
- Contrast similarities and differences of research practice internationally and provide a common protocol acknowledging best practice
- Develop a unified framework, conceptual model, and/or theories about the evaluation of ACT

III) INNOVATION IN TACKLING THE CHALLENGE

The high proportion of ECIs involved in this Action alongside established senior experts, guarantees that available expertise and methods used are up to date and that they have the potential to transfer this knowledge for several years in the future. Having SMEs and promising ACT start-ups in the network of proposers provides direct business input which is essential to achieve technological innovation. Furthermore, the socio-economic innovation of this Action lays primarily in the assembly of experts with such multidisciplinary background. Including experts with specialisation in transport, logistics, safety, engineering, informatics, ICT, human machine interaction, law, economics, business, urban planning, ethics, psychology and equity from Europe and beyond ensures a truly inclusive perspective in all challenges of ACT. Lastly, active dissemination of outputs to diverse audiences across COST member countries during the early stages of this Action will safeguard ample outreach which in turn will trigger wider synergies across borders and disciplines during the later stages.

D) ADDED VALUE OF NETWORKING

I) IN RELATION TO THE CHALLENGE

To develop a comprehensive and transdisciplinary solution to this challenge it is imperative to create a network of experts with diverse backgrounds. This gap in ACT practice and research has been identified mainly due to the silos of the automotive industry. Therefore, it has been established that COST is the appropriate scheme to surpass those silos and make a constructive contribution about this rapidly evolving challenge. The objective is to offer active networking opportunities to early career and established academics with local, national and EU level policy makers, as well as with practitioners. Moreover, by networking and collaborating with experts from different countries, this Action aims at contributing at the development of common terminology which is crucial when developing common international frameworks and regulations. Furthermore, the high participation from ITCs allows participants from those countries to familiarise with the latest technological developments from other COST and IPC countries in a rapidly evolving field and explore future collaborations which can expand their research capacity. The latter can lead to long lasting relationships and benefits e.g. joint research projects, common standards fora.

II) IN RELATION TO EXISTING EFFORTS AT EUROPEAN AND/OR INTERNATIONAL LEVEL

To date, there have been limited schemes allowing direct interaction between automotive manufacturers, academics and policy makers, particularly across different countries and continents. No other COST Action has focused on this topic so far, although there has been a number of Actions with relevant objectives. Action TU1102 – ARTS has been the most relevant one, though focusing more on the engineering and computer science aspects of road transport support systems. In contrast, this Action focuses more on the business, social and regulatory dimensions of ACT. Another ongoing relevant Action is IC1203 – European Network Exploring Research into Geospatial Information Crowdsourcing: software and methodologies for harnessing geographic information from the crowd which can provide valuable insight regarding voluntary data use. Other Actions with some relevance are: TU1004 – Modelling PublicTransport Passenger Flows in the Era of Intelligent Transport Systems which had a major focus on public transport, TU1209 – Transport Equity Analysis which will provide a framework to evaluate equity issues within this Action, TU1302 – Satellite Positioning Performance Assessment for Road Transport which focuses on Global Navigation Satellite Systems and highlighted the role of common standards and certifications, TU1305 – Social networks and travel behaviour which can provide useful insight about social networks to this Action. Earlier COST Actions TU306 – Automatic transmission of transport data and TU355 – Changing behaviour towards a more sustainable transport system did set the foundations for this Action. Numerous research projects funded through the European Commission Framework Programme (H2020) have conducted relevant research and it is anticipated that this Action will benefit by using previous and contemporary outputs. The following is an indicative list of research projects about ACT:

- AINARA – Automation and Intelligence Solutions for Automated Road Transport Systems
- CARTRE – Coordination of Automated Road Transport Deployment for Europe
- CATS – City Alternative Transport System
- CityMobil2 – Cities Demonstrating Automated Road Passenger Transport
- MarketUp – Transport Research Market Uptake
- MAVEN – Managing Automated Vehicles Enhances Network
- OPTICITIES – Optimise Citizen Mobility and Freight Management in Urban Environments
- OPTIMISM – Optimising Passenger Transport Information to Materialize Insights for Sustainable Mobility

Deliverables and know-how of these and other European research projects will constitute the backbone of activities to meet the research objectives of this Action. In conjunction with existing networks and alliances at IPCs, this Action will establish an active network with mutual benefits not only across European countries, but also across continents.

2) IMPACT

A) EXPECTED IMPACT

I) SHORT-TERM AND LONG-TERM SCIENTIFIC, TECHNOLOGICAL, AND/OR SOCIOECONOMIC IMPACTS

Impact will naturally vary during the course of this Action. Initially it will revolve around increasing awareness about and engagement with this Action. At the last years of this Action it is foreseen that outputs will be acted on with evidence of exploitation by organisations. The long-term impacts are envisaged to materialise beyond the term of this

Action, particularly if the scenarios outlined by C-ITS in section 1.A.IIare confirmed since positive business and social impacts will materialise during 2022-2026 depending on deployment and adoption rates.

Scientific impact

in the short-term:

- devise a unified interdisciplinary conceptual framework to evaluate the wider impacts of ACT
- compare simulation and user acceptance findings of various research projects to develop scenario inputs for diverse alternatives (localities, users, societal aspects)

in the long-term:

- develop robust methodological approaches for data collection and analysis prior to ACTdeployment
- enhance ECI skills in evaluating wider impacts of ACT deployment
- break silos which hinder collaboration currently between stakeholders e.g. academics and the ACT industry, to facilitate interdisciplinary research by establishing a European network to share relevant scientific knowledge

Technological impact

in the short-term:

- develop an online glossary including common terminology to be used across countries and disciplines
- create a database of ACT trials across COST member countries and participating IPCs

in the long-term:

- develop a White Paper for local/national authorities which will contribute in the development of technical standards and regulations
- define appropriate data visualisation formats to be used across disciplines and communicate key information regarding the deployment of ACT
- release in several European languages a series of short videos by different stakeholders explaining the opportunities and risks of ACT as well as risk mitigation measures

Socioeconomic impact

in the short-term:

- launch a platform of collaboration among experts and teams to bridge distinct scientific fields and facilitate consolidation of existing research strands building a collaborative ACT community
- identify essential ACT related skills currently missing in academia, industry, policy making

in the long-term:

- inform the general public about wider impacts of ACT deployment e.g. equity, liability, privacy
- create and disseminate a guide of best-practice for local authorities focusing on institutional and regulatory issues

- create and disseminate a guide of best-practice for practitioners focusing on business and socioeconomic issues

B) MEASURES TO MAXIMISE IMPACT

I) PLAN FOR INVOLVING THE MOST RELEVANT STAKEHOLDERS

A specific selection process has been followed during the development of the network of proposers for this Action. The criteria used are to have been involved in ACT related research or development activities, and/or to have been or plan to be involved in an ACT trial. Additional criteria are to be located in COST countries where no proposer exists in the network to ensure geographic coverage. Preference is given to ECIs, female stakeholders and those from ITCs since those groups are usually underrepresented in such networks within the transport sector and the objective is to ensure balanced representation both geographically and across stakeholder types. Within the first six months of this Action, criteria will be reviewed and updated accordingly to ensure participation by the most relevant stakeholders. The Policy Leader will assist in this task and efforts will concentrate in engaging with European Commission's institutions (e.g. Joint Research Centres), automotive manufacturers and local authorities, since those types of stakeholder could add additional value to this Action.

Overall, the plan for this Action is to have a mix of established researchers and ECIs; transport planners and practitioners from local/national authorities (e.g. safety/regulation/standard experts); practitioners from the logistics industry which may be among the first ones to adopt AVs; engineers who have experience in automotive design or transport infrastructure provision; software and artificial intelligence developers since it is important to trigger discussions between them and social scientists; economists and business experts to analyse the macro- and micro- economic impacts; social scientists and legal informatics experts who can contribute in the conceptual framework development e.g. about liability, privacy, ethics and equity. Engagement will take place through conferences, academic and professional mailing lists, academic and professional associations, as well as through existing network proposers who hold key roles at ACT related international networks.

II) DISSEMINATION AND/OR EXPLOITATION PLAN

A Dissemination Coordinator will be in charge and will supervise all dissemination activities. The work of this Action and its Working Groups will be disseminated primarily to the participants of this Action but also to wider audiences through a range of channels including:

Events (which include both face-to-face and online communication e.g. teleconferences)

Themed Workshops: organised by specific WGs but open to all Action participants.Working Group (WG) and Management Committee (MC) meetings: one per year (more will take place online).

Training Schools (TS): two themed TS in the last three years of this Action, targeting PhDstudents and ECIs, including keynote lectures by renowned academics and industry experts from Europe or IPCs, participant posters/presentations, panel discussions, academic debates, mini-training sessions aiming at skills development.

Short-Term Scientific Missions (STSM): to enhance networking and knowledge transfer throughout the Action (up to 6 annually). Largely aimed at ECIs who wish to familiarise with new autonomous technology, observe an ACT trial, learn how to apply a new methodology, write a collaborative research proposal.

Idea Jam event: prize winning competition aiming at identifying innovative ideas and/or businessmodels to exploit ACT in locations with diverse ICT infrastructure. It will target ECIs who will be mentored for a week by experienced Action participants and will take place online across various COST member countries and IPCs.

Special session at international conference: to engage with leading experts in the field and increase outreach while acting as an interim milestone for the Action.

Final conference: to showcase Action outputs, engage with diverse stakeholders (academics, practitioners, policy makers, civil society organisations), coordinate joint publications, arrange follow up activities.

Publications

Scientific publications in prestigious conferences (e.g. AET European Transport Conference) and/or peer reviewed journals (e.g. Transportation Research Part A: Policy and Practice, Transport Policy).

Special Issue in peer reviewed journal (e.g. Transport Reviews) tentatively focusing on: Successful ACT business models; Social impacts of ACT: liability, ethics and equity; Smart transport deployment in Europe: state-of-the-art review.

*Handbook / Edited book*summarising Action outputs which can contribute inthe long-termAction impact.

White Paper (including Glossary) about ACT regulations which will form the input for standards development at national or international level.

Best-practice case studies in several European languages outlining challenges faced in selected locations and how to overcome those.

Training material prepared for the Training Schools (e.g. lecture slides, activities outline, reading lists).

Online communication channels

Action website which will be the main communication channel and repository will remain available even after the end of this Action.

Mailing lists (academic and professional) and institutional (e.g. University) websites to disseminate outputs and achievements nationally and internationally.

*Action blog*offering an opportunity for direct engagement with the wider public and to allow direct feedback on Action outputs.

Twitter/social media account to allow direct contact with diverse audiences and publicise events. YouTube channel to upload short videos and interviews (in several languages) following all events.

WISE-ACT webinars (at least once a year) to provide insight about outputs and explain TS objectives and content.

Policy Coordinator to engage with policy makers at various levels (local, national, international) and exploit opportunities to transform outputs into policy.

C) POTENTIAL FOR INNOVATION VERSUS RISK LEVEL

I) POTENTIAL FOR SCIENTIFIC, TECHNOLOGICAL AND/OR SOCIOECONOMIC INNOVATION BREAKTHROUGHS

This Action is ambitious and to meet its objectives it includes geographically dispersed participants from diverse disciplines, expertise and career levels. The challenge has wide-ranging implications across several themes and evaluated through numerous scenarios, with the major anticipated output being of value to a series of stakeholders including automotive manufacturers, local/national authorities, insurance companies, established and start-up businesses, as well as academic institutions. Naturally, when involving a high number of experts from dissimilar backgrounds, there is always a risk of having fundamentally opposing views or requiring significant resources and time to coordinate activities and reach consensus. The proposers acknowledge this risk, but at the same time acknowledge the added value offered through such a network when aiming at delivering a breakthrough scientific innovation through a unified framework about ACT. In addition, having ECIs in key roles of responsibility may pose additional risks. Yet, the fact that each ECI will be mentored by an experienced participant, ensures a smooth process and minimises any risks. As another mitigation measure, risk levels will be reassessed at each MC meeting and appropriate contingency plans will be devised and implemented.

3) IMPLEMENTATION

A) DESCRIPTION OF THE WORK PLAN

I) DESCRIPTION OF WORKING GROUPS

Five Working Groups will carry out the work of this Action based on the research agenda, pre-defined tasks, specified deliverables and facilitated by COST Action tools and the Dissemination Coordinator:

WG1 – Institutional and Regulatory challenges

This WG aims at conducting an extensive review and evaluation of the existing institutional, regulatory and legal frameworks driving the deployment of ACT services. The anticipation of AVs to be shared and electric (EVs – Electric Vehicles) will reduce state revenues through road and fuel tax, so this needs to be factored in any relevant analysis. Since it has been identified that a new legal framework is required for fully autonomous vehicles, the objective of WG1 is toidentify major barriers as well as to identify efficient policy recommendations to accelerate the deployment of ACT services minimising any risks. The key tasks of this WG are to:

- T1: identify the macro-economic and fiscal implications of ACT and propose appropriate policy measures.
- T2: review the required legal framework including its underlying ethics and accommodating liability concerns.
- T3: explore safety scenarios of widespread ACT deployment and inform the development of relevant standards.

WG1 Deliverables include: Report to MC confirming scope, objectives, deliverables and milestones; thematic workshop report on institutional and regulatory challenges, White Paper about regulations (including Glossary); training materials for relevant session at TS; annual progress reports.

WG2 – Social challenges

As previously discussed, ACT will introduce various social challenges. Travel time use for example may stop being a negative externality and may turn into productive time. How will this impact conventional transport evaluation practice? This WG aims at defining the key social challenges, namely accessibility, equity, personal security and privacy ones. As mentioned in section 1.D.IIit will utilise input from other COST Actions and research projects to:

- T4: understand the value of travel time under an ACT scenario.
- T5: evaluate the privacy and security concerns emerging from the deployment of ACT.
- T6: categorise the anticipated equity impacts and propose suitable principles and criteria foran inclusive and fair transport system of the future.

WG2 Deliverables include: Report to MC confirming scope, objectives, deliverables and milestones; thematic workshop report on the various social challenges; training materials for relevant sessions at TS; annual progress reports.

WG3 – Business challenges

ACT triggers a wide variety of business challenges. Section 1.C.Ished light on the magnitude of potential ACT benefits. The logistics sector is certainly one to benefit by ACT through reduced fuel consumption as well as delivery time. However, there is a lot of uncertainty regarding the transition period or adoption rate to name some examples. The key tasks of this WG though are business models:

- T7: examine business implications for the logistics sector.
- T8:classify viable business models.

WG3 Deliverables include: Report to MC confirming scope, objectives, deliverables andmilestones; thematic workshop report on business challenges; training materials for relevant sessions at TS; annual progress reports.

WG4 – Transport system

This WG studies the penetration of AVs to the transport system and seeks to understand the key drivers for their successful integration during the transition phase. In this respect, the objective of this WG is to examine the demand side by trying to understand users' travel behaviour as well as identify the key planning principles for a successful integration of the AVs into the future transport system from the supply side. Key tasks of this WG are to:

- T9: identify the key economic, social, demographic, behavioural and cultural factors and barriers that determine a positive attitude of users towards AVs introduction.
- T10: analyse thebehaviour of AV end users by comparing their preferences and choices based on hypothetical mobility options through existing Stated-Preference experiments.
- T11: propose a taxonomy of potential sites for deployment of AVs while taking into account the geographical, social, economic, environmental and transport characteristics of the areas under study.

WG4 Deliverables include: Report to MC confirming scope, objectives, deliverables and milestones; thematic workshop report on transport system supply and demand challenges; training materials for relevant sessions at TS, annual progress reports.
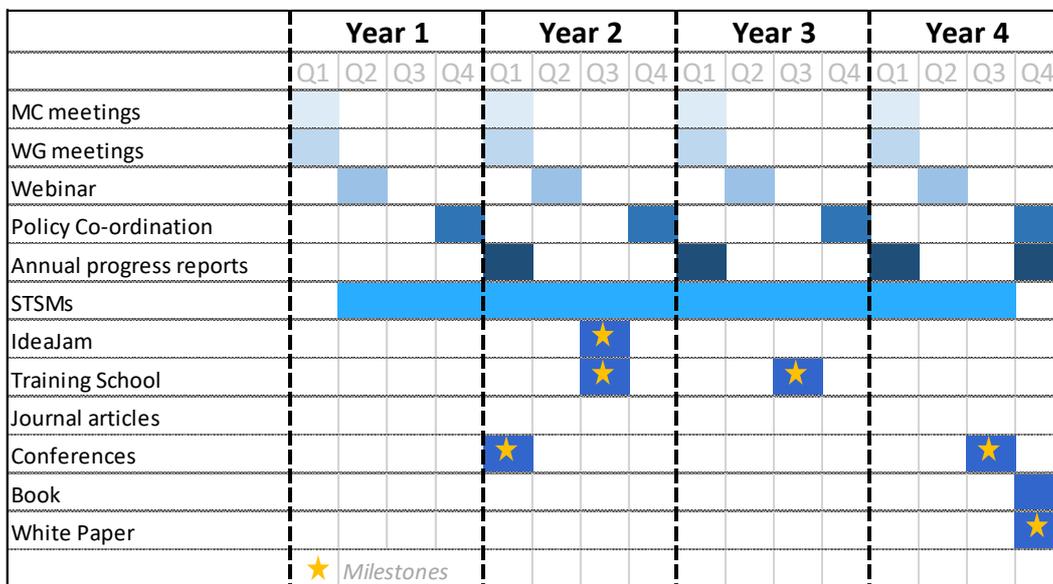
WG5 – Scenario development

This WG will utilise previous simulation data to conduct analysis and inform the scenario development. Assessed impacts include traffic congestion and environmental impacts among others. The key tasks of this WG are to:

- T12: develop and evaluate a number of scenarios of AVs deployment throughout Europe.
- T13: compare the results of simulation analyses across different localities.
- T14: develop a set of criteria and indicators which can inform policy makers about deployment of ACT in a certain locality.

WG5 Deliverables include: Report to MC confirming scope, objectives, deliverables and milestones; thematic workshop report on diverse and adaptive scenarios; training materials for relevant sessions at TS; annual progress reports.

II) GANTT DIAGRAM

This Gantt diagram demonstrates key activities, highlighting milestones which will act as interim evaluation points for the Managing Committee, Core Group and Working Groups.

	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
MC meetings																
WG meetings																
Webinar																
Policy Co-ordination																
Annual progress reports																
STSMs																
IdeaJam								★								
Training School								★			★					
Journal articles																
Conferences					★										★	
Book																
White Paper																★
	★	Milestones														

III) RISK AND CONTINGENCY PLANS

The Chair, vice-Chair and MC will be responsible for monitoring activities, managing risks, and taking corrective action when required. The following table contains an indicative list of potential risks, their probability and the respective contingency plans. This table will be revised and updated accordingly at each MC meeting.

	Risk	Probability	Contingency plan
ADMINISTRATIVE	Ineffective MC and WG Leaders	Low	Identify and recruit the most effective WG Leadersbased on expertise and experience. Each ECI WG Leader will be mentored by an experiencedWG Leader, so this risk will be minimised.
	Meeting frequency and geographical dispersion challenges	Low	Use online media to maintain regular effective communication. Review regular meetings frequency at MC annually.

SOCIAL	Language barriers / Using diverse terminology	Medium	Acknowledged initially. Alternative communication channels will be sought e.g. verbally, in writing.
	Professional rivalries may hinder scientific progress	Low	Matching each experiencedWG Leader with an ECI and support collaboration between academics and practitioners.
TECHNOLOGICAL	Technological changes impose an impact on the research	High	Update tasks and deliverables accordingly after consulting industry experts.
	Access to data becomes restricted	Low	Every attempt will be made to ensure that all data used in the Action will be Open Data or under a Commons agreement if possible.
	Access to analysis software or publications becomes restricted	Medium	Alternatives will be sought through established Universities participating in the Action.
QUALITY	Poor quality research	Low	The Action will actively seek researchers with strong/developing track record.
	Low commitment to Action	Low	WG Leaders will monitor quality of work and will have the option to replace participants.

B) MANAGEMENT STRUCTURES AND PROCEDURES

The Action will have the following management structure and procedures:

A Management Committee (MC), that meets once a year, will oversee and coordinate the work of the Action and make strategic decisions regarding the scientific programme, evaluate the progress of the Action, e.g., status of Action objectives, and make recommendations for future activities. It will also recruit and evaluate new members, assess new proposals, and determine policy for the Action. The MC will include two members from each participating COST country as well as: Chair, Vice-Chair, Secretary (to handle communications and actionable items from meetings), 10 WG Leaders (2 x 5 WGs), STSM Coordinator (to monitor, evaluate and recommend proposals from ECIs), Training School (TS) Coordinator (to coordinate the TS), Dissemination Coordinator (to oversee the website, monitor research outputs, coordinate with WGs to ensure that research is disseminated to the relevant stakeholders across COST member countries).

A Core Group (CG), which meets at least twice a year in person or virtually, will oversee the daily operations of the Action, monitor milestones and deliverables, and assist the MC. It will facilitate communication and coordination among the WGs, set the MC meeting agenda, implement MC decisions, coordinate dissemination of the Action's work, manage knowledge transfer to stakeholders and act as a reviewing panel to assess, for example, competitive proposals for STSMs. The CG will be composed of the MC Chair, MC Vice-Chair, MC Secretary, 10 WG Leaders (only one of each WG required to attend CG meetings), STSM Coordinator, TS Coordinator, and Dissemination Coordinator.

The five Working Groups (WGs) will carry out the scientific work, that is, do the work of the Action, coordinating research from participants, and organising meetings around the priority themes. Each will have two Leaders (WGLs), with one role to be performed by an experienced participant and one by an ECI. Both will be responsible fororganising WG meetings, setting the agendas, ensuring each meeting has adequate representation,

producing a summary outcome, and reporting annually to the MC. They also will be responsible for ensuring the membership has a balanced mix of ECIs and experienced participants, of gender, and of geographical representation. Each WG will have a Dissemination Coordinator who will liaise with the MC Dissemination Coordinator, ensuring that the work is disseminated to the Action and beyond. At the outset, each WG will develop a plan for how it will address the research objectives, and, if necessary, modify the scheduled deliverables and milestones. WG meetings are an opportunity for members to present research findings, plan for the future, and engage in collaborative activities.

The key activities and events are described under 2.B.IIincluding e.g. TS, STSMs, international conferences. For all Action events, appropriate plans will be put into place to prioritise participation by under-represented groups, e.g. gender, ECIs, ITCs. The CG, MC and WGs will meet together in the same physical location each year to minimise costs and maximise interaction amongst Action members. The physical location will vary from year to year to strengthen the construction of a pan-European network. Progress and achievements will be monitored annually with each WG submitting a short annual report on its activities to the MC which in turn will do a self-report on the progress of the Action based on its proposed deliverables and milestones. A key dissemination tool will be the Action's website which will be managed by the Dissemination Coordinator and a small sub-committee (which will change annually) to distribute the workload. An operational plan will be developed with the objective of having a controlled, but effective set of tasks. The plan will be evaluated and revised (if necessary) by the MC on an annual basis. Dissemination will happen both passively (website) and actively (social media) e.g. Twitter, as well as through mailing lists. The Action will maintain a mailing list for those who want to be notified directly about events and activities organised by this Action, as well as separate mailing lists for targeted groups (e.g. WGs, MC) so that information is targeted to the right people in a constructive way. In addition, the Action will use novel approaches (e.g., SurveyMonkey, Snap) to engage stakeholder groups, extracting insights and reflections in a more efficient manner. To enhance our external presence and global interaction, the Action will invite selected experts from outside Europe to attend meetings and give guest lectures/seminars so that this Action'swork will benefit from their expertise. In doing so, this will ensure also that this Action's outputs are disseminated worldwide.

C) NETWORK AS A WHOLE

Having 41 proposers from 22 COST countries provides sufficient geographical distribution and breadth of expertise while at the same time it provides sufficient depth individually in the respective areas of expertise. Since there is a good mix of engineers and social scientists, including economists, business and media experts as well as computer scientists, there is confidence that this network possesses the required critical mass to address the aims of this Action. There are more than 40% of proposers from ITC and more than 50% are ECIs which means that there is a good mix of participants blending experience with enthusiasm. Previous experience of proposers in COST Actions and in organising and hosting international workshops as well as disseminating research outputs to media warrant that the challenge can be addressed. The selected institutions from IPC have experience on autonomous transport, innovation, logistics, marketing, privacy, data management and they are based in countries were ACT trials are taking place, so they are in a position to make a useful contribution to this Action. Their contribution will be of mutual benefit as European researchers and practitioners will exchange know how and improve their capacity by collaborating with such international leading experts.