D6.2 Knowledge Translation, outreach, safety awareness.

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Copyright statement

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Executive summary

While automated driving systems and autonomous vehicles are being designed to avoid or compensate for many typical human failures that lead to road crashes, new risks are expected to emerge from changes in the interactions among road users and gaps in knowledge on automated systems and their limitations. Awareness of possible new risk scenarios and proper use of safety innovations is important for all road users, but especially with regard to ensuring the safety of people walking, cycling, pushing a wheelchair or riding a motorcycle. In WP6, *Training activities and awareness creation on future traffic scenarios*, SAFE-UP recognizes the role of updateable training, education and awareness raising (TE&A) strategies to complement the implementation of safety innovations for future AV traffic.

In this Task 6.3, Knowledge Translation (KT) is applied as the methodology and framework to support of Work Package 6 objectives. KT addresses the *knowledge-to-action* gap by applying processes and practices to facilitate targeted dissemination of research tailored to specific user audiences to facilitate uptake and application. Despite few examples of KT applied to road safety innovation, leveraging the knowledge and tools from this field offers the potential to enhance the impact of road safety innovations from SAFE-UP and beyond.

The KT plan for Task (T6.3) described in this report is evolving and iterative, integrating the emerging results of the different technical work packages – WP2 future Safety-Critical Scenarios and the WP3 Demos 2, 3 *Enhanced sensors & active safety for URU detection and avoidance* and Demo 4 *Timely warnings delivered through connected devices*. Creation of the SAFE-UP KT plan guided by the Knowledge Translation Planning Template© which lays out the essential components for planning pathways from research to impact. Key steps in the plan follow a logic flow. Target knowledge users (KUs) are identified and then from main messages (MMs) are crafted from project results. Then, setting KT goals, and creating KT strategies are aligned with MMs and KUs, to ensure that the materials and strategies developed are user-centred, relevant, accessible, useable and timely.

Successful KT leverages stakeholder engagement through knowledge exchange activities to pull information from target groups on their needs, and to synthesize relevant, actionable messaging from research outcomes. This document reports on KT activities for the first half of SAFE-UP, in which we initiated outreach and engagement to form an initial scalable Safety Partner Network (SPN) of organizations representing different sectors of the road safety ecosystem. Importantly, these included advocacy groups promoting unprotected road user modes – federations of associations of pedestrians, cyclists and motorcyclists of the EU and beyond. As well, we are engaging with organizations representing European driving schools, cities planning for future mobility, and ITS stakeholders.

A general takeaway message from SPN engagement thus far is the importance and challenge of communicating road safety research results in ways that are already contextualized in the concerns and goals of URUs and their representatives. Indeed, for researchers to be considered credible and up-to-date with current URU mobility issues, research communications must convey an appropriate level of literacy about the lived

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contexts in which RSI will be implemented. Importantly, two conflicts between user needs and project objectives have been identified early on. There are concerns around wearable C-ITS devices for URUs (pedestrians and cyclists) regarding ethics, personal freedoms, accessibility and possible shifting of liability (to URUs). As well, training, education and awareness for cyclists and pedestrians on current and future road safety must not be placed at the forefront of 'safety' interventions, since (re)design of transport systems to *remove danger* is now the prevailing paradigm within the safe systems approach to Vision Zero. The car-centric history of treating the vulnerable as the problem, was strongly emphasized to highlight the need shift the discourse to address the sources of danger, and not expect the most vulnerable to learn how to adapt to it. Members of the SPN are adept at parsing the difference between 'rule breaking' by URUs that 'cause' crashes, and infrastructure and/or vehicle deficiencies that produce predictable crash situations. Additionally, appropriate messaging will encourage active mode use instead of discouraging it through increased perception of danger.

Representatives of PTW riders, while also unprotected road users, find that PTWs are often omitted from discussions and research, both as URUs and as motorized vehicles integral to the modal mix. The most common and severe accident scenarios for riders is the same today as it was decades ago, while gaps persist in effective (delivery of) training for riders or interventions that address the well-known problem of car drivers' difficulty in perceiving PTWs or accurately assessing their speed. Proponents see an ongoing need for rider training in hazard anticipation and safety strategies, together with training for proper use and confidence in on-board advanced safety systems. However, reducing the risk to riders significantly cannot be achieved without C-ITS solutions to support drivers and riders.

These contributions from SPN members – perspectives about road danger from the vulnerable mode points of view and identification of gaps within the research paradigm to properly take these into account, is important for stimulating dialogue to enable development of TE&A strategies that communicate honestly and clearly about system use cases and limitations while clearly identifying and explaining specific advantages in mitigating road danger. As well, in order for proposed strategies to be acceptable, effective and sustainable, they must contextualized within the current accepted paradigms that aim to leverage the safe systems approach and promote active mode use for more liveable, sustainable cities. The knowledge gained through the SPN, as well as the standards and resources available online about URU safety promotion and communication of road danger/safety are being compiled in a SAFE-UP KT Handbook for researchers.

This deliverable describes the processes developed and being applied to creating training, education and awareness strategies to promote URU safety in future mixed AV traffic. We envision that this 'experiment in KT for road safety innovation' will also represent a project outcome. It is hoped that some of the processes and partner relationships developed during the life of SAFE-UP will continue to be relevant beyond end of grant. This deliverable is offered not only as a report on the work, but as an introduction to knowledge translation principles and practices to aid researchers, developers and stakeholders in RSI.

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List of abbreviations

Abbreviation	Meaning
ABS	anti-lock braking system
ACEM	European Association of Motorcycle Manufacturers
AD	Autonomous Driving
AV	Autonomous Vehicles
CA	Consortium Agreement
CAV	Connected Automated Vehicles
CITS	Connected Intelligent Transport Systems
D	Deliverable
DoA	Description of Activities
EC	European Commission
ECF	European Cyclists Federation
EFA	European Driving Schools Association
ETSC	European Transport Safety Council
FEMA	Federation of European Motorcyclists' Associations
FIM	Fédération Internationale de Motocyclisme
GA	Grant Agreement
GIDAS	German In-Depth Accident Study
IFP	International Federation of Pedestrians
IFZ	Institute for two-wheeled safety
ITF	International Transport Forum
LO	Learning Outcome
KmB	Knowledge Mobilization

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Abbreviation	Meaning
KT	Knowledge Translation
KTE	Knowledge Translation & Exchange
KTPT©	Knowledge Translation Planning Template©
KU	Knowledge User
MAIDS	Motorcycle Accidents In Depth Study
MM	Main Message
OEM	Original Equipment Manufacturer
PTW	Powered two-wheelers – motorcycles, scooters, mopeds
R&I	Research and Innovation
RSI	Road safety innovation
SCS	Safety-Critical Scenario
SNP	Safety Network Partner
SPN	Safety Partner Network
T	Task
TE&A	Training, Education & Awareness
TLA	Teaching and learning activity
URU	Unprotected Road User
VRU	Vulnerable road user
WP	Work Package

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1. Introduction

"The major areas of scientific breakthrough in the future are not going to be within disciplines or fields, they are going to be at the nexus between disciplines and research users".

-- Dr. Matthew Flinders, Department of Politics and International Relations, University of Sheffield [1]

The importance of proactively addressing possible new risks to unprotected road users (URUs) due to disruptions expected to emerge from the evolving mixed automated traffic context have been well described in previous SAFE-UP deliverables [2, 3]. The statistics on serious injuries and fatalities to riders, pedestrians, cyclists, or powered two-wheeler (PTW) riders in conflicts with cars are also well documented (please see D2.6 [2]). Transport authorities, infrastructure providers and road safety researchers are striving to anticipate and avoid new hazards, while implementing autonomous vehicles (AV) and smart technology to mitigate the known crash causes. The relevance of WP6 rests in the recognition that this transition will not be a solely technological process, but also a social one, dependent on effective interactions not just among road users, but also amongst the organizations and individuals that contribute to the evolution of the mobility and transport systems, their stakeholders and the people affected by their decisions and actions. Here, road safety innovation comes full circle, since research impact will be measured, literally, at the level of "the people in the streets".

In future we may look back on the introduction of automated land transport as the second most impactful revolution in personal mobility since the initial introduction of the automobile in the early 20th century. That revolution was accompanied by unprecedented numbers of traffic fatalities and injuries, mostly to the people outside of the cars, with a particularly high toll among children [4, 5]. The introduction of safety interventions such as infrastructural support (traffic lights, stop signs and lane markings), safety technology for vehicles (turn indicators, brake lights and head lamps), education on new behaviours and skills for drivers and other road users, and new policy and legislation were not planned for in advance but evolved with the exploding epidemic of road fatalities and injuries, implemented as crisis control measures [4]. A similar crisis accompanying AV penetration is unthinkable. Researchers strive to anticipate needed safety functions, ministries, to make decisions involving highly technical information, and vehicle manufacturers, to maintain market competitiveness while developing the automation technology influenced by evolving standards, ethical and liability issues. Yet for now our understanding of future needs is based on data from past traffic conflicts. While automated driving systems are designed to avoid or compensate for many typical human failures that lead to crashes, new risks are expected to emerge from changes in the interactions among vehicles and unprotected (a.k.a.

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vulnerable) road users. Consequently, traffic participants may need to adopt new behaviours, learn to watch out for new hazards, or exchange new cues to communicate each other's intentions effectively and thus avoid safety-critical scenarios between car drivers and URUs. Operators/drivers may need to acquire new competencies to ensure that automated vehicles and systems are used properly. Road users may need to be informed about traffic participation changes and new technologies that affect their behaviours and choices. Thus, training, education and awareness raising are seen as an important complements to innovation for protecting road users, however the burden of responsibility for safety cannot be placed solely on those most exposed to road danger. Taking a safe systems approach means considering the multiple factors interacting to create road danger. This requires the synthesis of knowledge from multiple evidence sources, multiple points of view, leveraging diverse expertise areas to co-create effective, timely and sustainable solutions. In light of this complexity, the quote by Matthew Flinders at the beginning of this chapter is particularly pertinent.

The challenge for WP6 is to determine how we can educate and inform behaviour and practice change to improve URU safety in current and future safety-critical scenarios, based on the current (and evolving) knowledge. The main objectives of Task 6.3 are to develop a systematic approach for translating project outcomes into key messages and strategies to promote safety of unprotected road users in an evolving mixed automated traffic context. The approach implemented is Knowledge Translation (KT), which leverages research on how to successfully execute targeted dissemination of information and intervention materials to a specific audience(s) to achieve greater use and impact of research outcomes [6]. This systematic approach is distinguished from traditional academic dissemination which relies on passive diffusion of knowledge through journal publication [6].

KT is considered essential for bridging the gap from research to practice and ensuring that research innovations are applied more effectively and efficiently in policy and practice [7]. Indeed, research funders in health and social services research increasingly require that grant applicants include plans detailing how research outputs will be turned into impacts. Having been developed for decades in the health research to successfully facilitate the uptake and use of outcomes, KT has so far been little applied to road safety innovation (RSI).

In applying the system and practice of KT to SAFE-UP, the evolving plan developed and applied in Task 6.3 guides the processes that support WP6 objectives. Consequently, T6.3 runs throughout the entire project. For our purposes, KT is applied *after* the project research objectives were defined. Further, we extend the concept of 'practice' beyond the relevant activities of institutions and organizations within the road safety ecosystem to apply also to road users/end users actively interacting within the traffic system. We see this project and the WP6 role as an opportunity to apply, develop and test the application of knowledge translation to road safety innovation, while fulfilling the objectives already defined.

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Main outcomes towards WP6 stated objectives

This deliverable reports on the work performed in Task 6.3 Knowledge Translation, outreach and raising awareness up until M18. An evidence-informed framework for planning effective targeted dissemination towards impact, the KT Planning Template© (KTPT) [8], was selected as the underlying methodology to guide WP6 activities in support of all 4 tasks. As this task spans the entire project, a final deliverable will report the outcomes realized during the second half of the project. The primary activities reported here are the development and application of the knowledge translation processes and practices, including the evolving KT plan, outreach and engagement through creation of the Safety Partner Network, processes for defining the main messages as the content bases for training, education and awareness (TE&A) objectives (see deliverable D6.1 section 4.3 [3]), KT tools and resources for researchers, and initial dissemination materials created for the Safety Media Library translated from early project results. The overall strategy is thus to provide the same information in multiple formats, targeting a variety of audiences, to allow amplification of the message, through multiple delivery channels, and thus optimize reach and impact. Such a *combined KT strategies* approach not only makes the most of limited WP6 resources, it follows evidence-based best practice recommendations for KT strategy effectiveness [9]. The Safety Media Library will serve as a publicly accessible repository of all the KT and training products that are created in WP6.

Table 1.1 provides a summary of Task 6.3 subtasks and status as of month 18. An important aspect of this task up to M18 has been the development of the processes and activities necessary to providing the support and inputs for T6.1 in the identification of TE&A targets and objectives. These were based on results reported in the WP2 deliverable D2.6 *Use Case Definitions and Initial Safety-Critical Scenarios* and inputs collected from the Safety Network Partners and a survey of issues dominating the road safety discourse and evident on the websites of virtually every governmental and non-governmental road safety organization in Europe, North America and Australia. Initial TE&A objectives have been reported in D6.1 *Training needs, requirements, scenarios and KPIs* [3] and will be updated through this task as the project outcomes and engagement activities evolve. The final deliverable for T6.3, D6.3, will report more on outcomes such as KT products created and any initiatives created as well as evaluation of KT products and the KT plan. An overview of WP6 processes and proposed outcomes is provided in the slide in Figure 1.1.

Organization of the deliverable

Section 2 provides an overview of KT to familiarize the reader with essential concepts, terminology and applications, including its potential for road safety innovation. Section 3 describes applied methodologies, frameworks, tools and resources drawn from KT and implementation literature and KT organizations (leading organizations offer many free online resources). The section also describes some of the custom tools created to facilitate KT processes and knowledge management in T6.3. An overview of the Knowledge Translation Planning Template© [8] describes the steps for creating the KT plan, which provides the underlying framework for WP6. Sources of data and inputs for T6.3 follow the description of

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the KTPT©. Section 4 Outcomes and Status presents the evolving SAFE-UP KT Plan. Explanations of the steps of the SAFE-UP plan cover aspects that have been completed for our 1st cycle of knowledge translation (initiation of partner engagement and KT of initial safety-critical scenarios from D2.6).

Table 1.1 Task 6.3 subtasks and status (M18).

T6.3 Subtasks & status
SAFE-UP KT Plan • Develop (✓) and implement (…) a model for knowledge translation and outreach for road safety innovation…. • …including strategies for dissemination of safety messages/training material derived from T6.1 (…) and T6.2… • …to a subset of VRU groups (priorities to be defined in T6.1) in 3 selected pilot European contexts (regions) (TBD).
KT tools for researchers to build capacity • Adapt and develop tools to aid researchers in (i) dissemination of results to different stakeholders (✓, ...), (ii) measuring impact. • KT workshop to consortium members (date TBD).
Safety Partner Network • Create a small initial (scalable) network of key road safety promotion partners (✓), targeting international and national organizations with an online presence, active in accident prevention and safety of VRUs. • Leverage these partners' existing platforms, activities, resources and membership bases/reach to optimize dissemination of project training & awareness content (…).
SAFE-UP Knowledge Products on URU safety in evolving AV traffic • Information to promote understanding and raise awareness of safety risks to URUs with the new AV penetration of existing road environments (✓, ...). • Adaptations of the training programme material for broader access and use (pending outputs from T6.2).
Safety Multi-Media Library • A webpage dedicated to KT of project safety results providing downloadable educational materials and tools for free dissemination (…).

(✓) = completed during M1-18, (…) = ongoing, (TBD) = to be determined.

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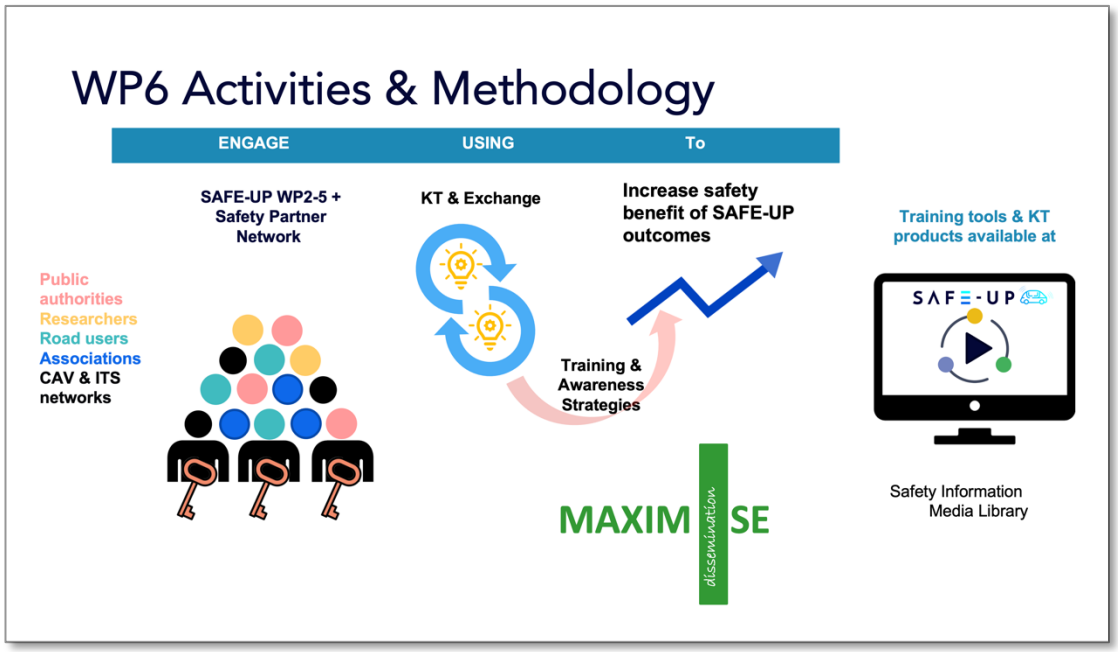

Figure 1.1 Overview of WP6 methodology guided by T6.3 and activities.

Details on the main outcomes towards stated objectives follow the SAFE-UP KT plan. The relevant subsections are: 4.2.1 – A detailed summary of the knowledge gained through SPN engagement meetings; 4.2.2 – A brief description of outputs to T6.1, already described in D6.1; 0 – A KT handbook for researchers (in process), being a compendium of tools, links, writing and communication guidelines, best practice examples, KT, implementation and behaviour change references; 4.2.4 – A catalogue of the knowledge sharing items produced to date. Finally, Section 5 summarizes the methodology and outcomes of T6.3 until M18 and discusses the application of KT for road safety innovation, the importance of stakeholder engagement, with some final words on implementation which is the next step beyond targeted dissemination of knowledge.

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2. Knowledge Translation and planning for impact

Knowledge translation is a system of processes and practices aimed at bridging the gap between research and practice, to avoid research waste and maximize societal benefits. A simple definition is, “Getting the right information to the right people at the right time in the right format so as to influence decision making” [10]. The earliest noted example dates back to 1914 when the US formalized programs in which agricultural research was shared through educational programs for farmers [11]. The Centre for Knowledge Translation on Disability & Rehabilitation Research (KTDRR) provides a detailed history of the evolution of the concepts, practices and applications of KT [12]. By the author’s account we are currently in the fourth wave of KT: *Contemporary Trends in Knowledge Translation (post-2000)* characterized by the creation of international priorities to reduce the gap between evidence and decision-making, implementation, and practice or behaviour change (see, e.g. [13, 14]). Fundamental to KT is the involvement of stakeholders or knowledge users in the collaborative exchange of knowledge to create relevant questions, interpret results, and co-create new knowledge syntheses [15].

KT has been highly developed and applied in health services particularly in Canada, the US, the UK and Australia to facilitate translation of research into improved practice and policy. Nevertheless, it is applicable to any research domain, since the principles and practices are neither content nor field specific. Increasingly, research funders are requiring knowledge translation plans as an essential component in grant applications to ensure accountability for public investment in research: “Researchers will be encouraged to identify who will use their findings and how they will be used and include in their applications a clear plan for ongoing consultation with users” [14]. Increasingly public sector organizations are adopting mandates to promote strengthening of knowledge translation mechanisms for greater use of research evidence in decision making and practice (for an example see [16]).

KT is also known by many different names and related concepts. The specific term used may depend on the goals or stage of the research, on the organization or even geographical region [10]. A few of these are knowledge translation and exchange (KTE), knowledge mobilization (KmB), research impact, knowledge brokering, engaged scholarship, research translation, dissemination and implementation. It can also be utilized in technology transfer and commercialization. It is not synonymous with knowledge transfer – this term suggests a unidirectional flow of knowledge for producer to recipient, whereas KT requires knowledge exchange and synthesis with users. Knowledge transfer and tech transfer more commonly follow a ‘push’ model for delivering research outcomes, knowledge translation ‘pulls’ knowledge and needs from knowledge users or leverages linkages with stakeholders to co-create new knowledge syntheses. Graham et al. (2006) provide a conceptual framework for definitions and clarifications of the different terms [17] (see also [18] for a detailed treatment of the different terms, the functionalities they each describe and how they are related).

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The specific activities chosen for KT will differ depending on the nature of research, the stage of the research and the specific target audience or knowledge user (KU). The choice of the term *KU* aptly conveys the concept that the user is not a passive recipient of knowledge but actively engages with it to (co-)create new meanings or uses. In RSI, we believe this concept applies whether the intended KU is another researcher, policy maker, practitioner, educator, or 'end' user (i.e., road user, consumer).

The definition of knowledge translation by the Canadian Institutes of Health Research (CIHR) has been adapted by other organizations worldwide, including the World Health Organization (WHO). We borrow this definition in adapting it to RSI (see section 2.1).

> *"Knowledge translation is a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system. This process takes place within a complex system of interactions between researchers and knowledge users which may vary in intensity, complexity and level of engagement depending on the nature of the research and the findings as well as the needs of the particular knowledge user."* [19]

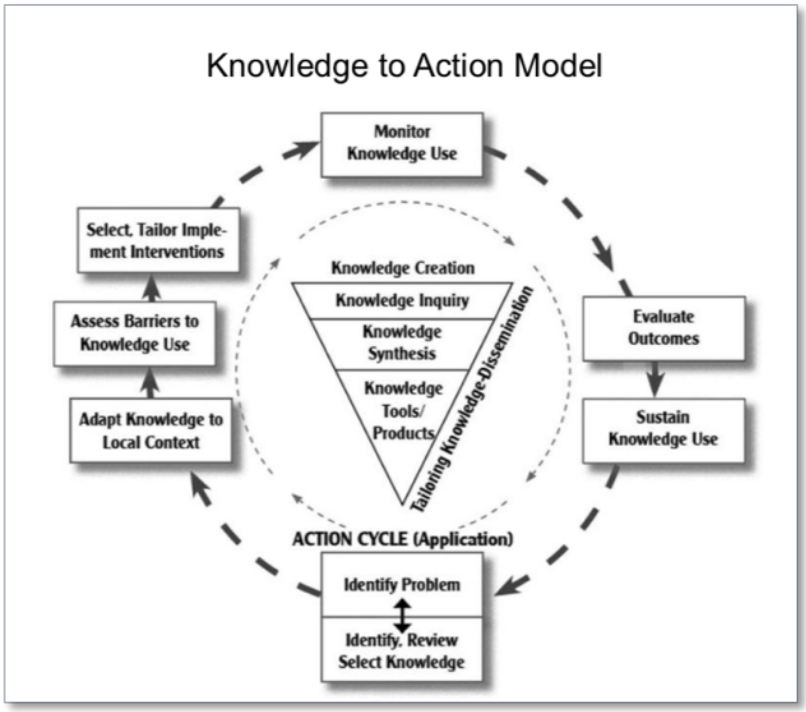

Figure 2.1 KT model developed by the CIHR [19].

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The CIHR Knowledge to Action model (Figure 2.1) [17] is a commonly cited example [20] and effective for conveying the complex dynamic and iterative processes involved in KT. The model resonates with the WP6 requirement for a flexible, updateable TE&A scheme(s), with clearly defined steps and processes to support development of such goals. The centre triangle shows the development of new knowledge (items) through the synthesis of research results (different sources of evidence). This process involves tailoring and dissemination of knowledge to target audiences. The elements on the circle identify the different activities needed to translate the knowledge into practice or policy change, evaluate the outcomes and track the impact. Coming full circle, the outcomes and the research questions can be updated based on evaluation and new knowledge generated from implementation or research. Despite being depicted as a cycle, the phases may be undertaken out of sequence, depending on project aims and methods. The knowledge-to-action model seems to be conceptually appealing for those new to the KT field. However, since it was not intended for describing activities of individual organizations, it has been criticized for not including components for monitoring progress towards impact within organizations [21]. Indeed, one model is not enough for a comprehensive KT plan and different ones may be needed in combination with one another or at different stages of the plan and project [6].

2.1 KT for Road Safety Innovation

"With a small number of exceptions, KTE has been infrequently examined in the road safety literature and is largely neglected by transport policy agencies. Considering the millions of deaths and injuries caused by road trauma each year, KTE has a critical role for enabling effective policy and practice, and the impending transformation of the road safety field over the coming decade."*

- Adrian Davis, Senior Fellow in Behaviour Change & Translational Research, UWE Bristol [22]

"UK, Norway, Sweden, NL are global road safety leaders with renowned KTE systems in place." [23]

**Knowledge Translation and Exchange*

KT is shown to be highly effective in facilitating the movement of research into application for improved public health practice and policy making. Traffic injuries are recognized as one of the leading public health issues worldwide. Nevertheless, there are scant examples of KT applied to road safety. We were able to find only a handful of examples (see [22, 24, 25, 26]).

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The following statement by Davis (2018) encapsulates the motivations of WP6 for applying KT to RSI in keeping with SAFE-UP's holistic approach to promoting safety in future AV traffic: "There are significant future road safety gains to be made by more effective use of Knowledge Translation & Exchange (KTE) through improved policy and practice…KTE offers the road safety community a mechanism to address current and future challenges by facilitating collaborative learning and coordinated actions among diverse stakeholders to promote evidence-informed policies and practices" [22].

In adapting KT principles to RSI, we think of 'practice change' as applying not just to researchers, original equipment manufacturers (OEMs), ministries, legislators, driving instructors or educators, but also to the individual citizens interacting with and among the traffic and transport systems.

WP6 together with the UNIFI partner group, whose focus and expertise is motorcycle safety, drafted the following definition for KT based on that of the CIHR:

Knowledge Translation for Road Safety Innovation is the exchange, synthesis and evidence-based application of knowledge, derived across road safety sectors – through a complex system of interactions among researchers, and users to accelerate, facilitate, and update the implementation of road safety innovations in a safe, acceptable and timely manner, including public education and awareness of new traffic interactions and technology.*

**'Users' as intended here are those who can benefit from the knowledge, also including the public sector, and the community of road users. Researchers may be academic and industrial.*

This definition is intended to be applicable to road safety research and practice in a very broad sense and extendable beyond the project to contribute to the evolution of better and safer transport solutions.

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3. Methodology

3.1 Tools for researchers

There are numerous literature references on KT as well as guides, frameworks, and tools freely available to support KT practices and processes. There are many tools and resources freely available online. Many of these have been/are being collected throughout WP6 activities and a compilation will be provided in the handbook.

Examples of KT Process tools:

- Models and framework for planning, organizing and carrying out KT
- Tools and frameworks for monitoring and evaluation of
    - KT plan execution – process and outcome measures
    - Tracking and measuring research dissemination, use and impact
- Data management tools
- IT tools for communications, data management, virtual meeting platforms

Examples of KT Production tools:

- Tools and tips for translating content into engaging and targeted knowledge products such as online infographics templates and creation
- Plain language writing and research synthesis guidelines

3.1.1 Theories, Models and Frameworks

(Source: [6])

There are many theories, models and frameworks (TMFs) to simplify, explain and facilitate Knowledge Translation. For example, choice of TMF will depend on the KT aspect, goals or timing in the project/KT plan. Different TMFs may be applicable at different stages of the KT process.

TMFs can be used to:

- Plan the steps in the KT process.
- Inform data collection, reporting and evaluation.
- Help understand what factors can influence our desired outcomes.
- Ensure a strategic approach to KT – all aspects of the topic, issues *and* process are considered.
- Facilitate communication with stakeholders through a common language.

Selection of the appropriate TMF(s) is based on the specific objective(s), e.g.:

- Promote adoption of a new idea or technology.
- Promote behaviour change.
- Understand the effects of context on KT and implementation efforts.

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- Strategically evaluate KT efforts.

Some TMFs identified as relevant to WP6 aims and KT plan include:

- Communications KT model (safety knowledge, behaviour change) [13, 27].
- Diffusion of innovations theory (uptake & acceptance of CITS) [28].
- Knowledge to Action framework [17, 19], and the KTPT© [8].
- Behaviour change wheel (inform KT strategy selection, priorities and feasibility within project scope) [29].

3.1.2 Tools available online

As previously mentioned, there are many existing tools, frameworks and examples for KT and impact planning and evaluation. As well there are many freely available tips, tools, and guides services for producing engaging and accessible knowledge products such as infographics or research summaries and syntheses. In addition, there are many online tools for communication and data collection like forms and polls, or interactive meeting apps. Many of these tools have free subscription options. In the interests of saving space, these references will not be included here but are being compiled and provided in a handbook for researchers (in process) described in Section 4.2.3.

3.1.3 Custom tools for SAFE-UP researchers

In Task 6.3 custom tools are created as needed to facilitate processes such as outreach and communication activities, or data management and tracking and checking to ensure approvals and fidelity of SAFE-UP data during translation into KT products. Tools are described in more detail in the following subsections. In parallel a document is being created for later development into a handbook for road safety researchers which includes links to the tools and resources as well as tips and guides on such things as plain language writing, and best practice language usage in road safety discourse.

3.1.3.1 Prioritizing KUs/partner identification and engagement timing

Table 3.1 is a matrix tool created for identifying knowledge user types (vertical axis) together with the timing for engagement or targeting during project life (horizontal axis). Note that while some of these KUs may be included in more than 1 column, the MM or KT goal, may differ in each instance.

Tier 1 KUs: internal and external partners

Who can help us to...

- *Achieve T6.3 goals by contributing resources, networking, endorsement, knowledge brokering?*
- *Define safety priorities, gaps in knowledge, barriers to uptake of results?*

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- *Determine next KUs?* (Prioritize & characterize target audiences (user/VRU type, demographics, regions, diversity, needs).
- *(Co)create new knowledge/materials/initiatives from project results?*
- *Develop strategies to implement knowledge sharing and KT goals?*

Tier 2 KUs: Next knowledge users

Tier 2 KUs could be those activated as intermediaries to be leveraged to help in evaluating and refining the new knowledge (co-created with Tier 1 KUs) and delivering to the end (road) users, such as educators, driving instructors, user associations.

Who can benefit from the knowledge co-created with the partners…

- *To reach URUs directly?*
- *To create KT initiatives and new knowledge products?*
- *To implement change (knowledge, skills, behaviour, policy, practice)?*

Tier 3 KUs: End users (where we wish to see the safety benefits manifested)

- *Who is targeted to benefit from/implement/enact the desired changes, education, awareness?* E.g.:
  - Service providers, front line personnel interacting with road users
  - Road users, consumers
- *What organizations, road safety professionals can leverage the knowledge produced/gained to increase impact?* E.g.:
  - Policy makers
  - Municipalities
  - Researchers

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Table 3.1 Matrix for determining priority knowledge users (as partners) and timing for targeting of different KUs.

Timing Priority	KU Type	T1 KUs	T2 & T3 KUs	T3 KUs
1	Researchers (Int & Ext)	X	X	X
1	**NGOs**, Charities Road Safety sector Accident/injury prevention	X	X	X
1-2	Service providers [?] Driving instructors Riding instructors	?	X	X
3	Decision Makers	?	X	X
1-2?	Policy makers Government Legislators (incl. licensing)	?	X	X
3	Media (TV, radio, online, news, magazines)		X	X
2-3	Consumers†		X	X
2-3	URUs‡ (pedestrians, cyclists, PTW riders, road workers) Other road users Professional drivers		X	X
1	Vehicle & ITS OEMs (SAFE-UP consortium)	X	?	X
3	Vehicle & **ITS** OEMs Transport system providers		X	X
	Other?			

As Next KUs: †Consumer groups, e.g., clubs; ‡URU specific groups or associations, e.g. motorcycling, cycling online communities. ITS = intelligent transport systems.

3.1.3.2 Questionnaire for potential SNPs

An online form, the *SAFE-UP Questionnaire to identify potential Safety Network Partners* (SNPs) (Figure 3.1) was created using Google Forms. Potential Safety Network Partners were invited to complete the form as a precursor to initiating discussions on possible collaboration or knowledge sharing. This tool was created to:

- Probe for interest in collaborating on WP6 activities
- Allow self-selection of organizations with aligned interests and mandates
- Collect profile information to better understand the organizations and ensure all relevant knowledge user groups were represented across the engaged organizations

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- Provide a starting point for engaging potential partner in discussions
- Use as an administrative and planning tool

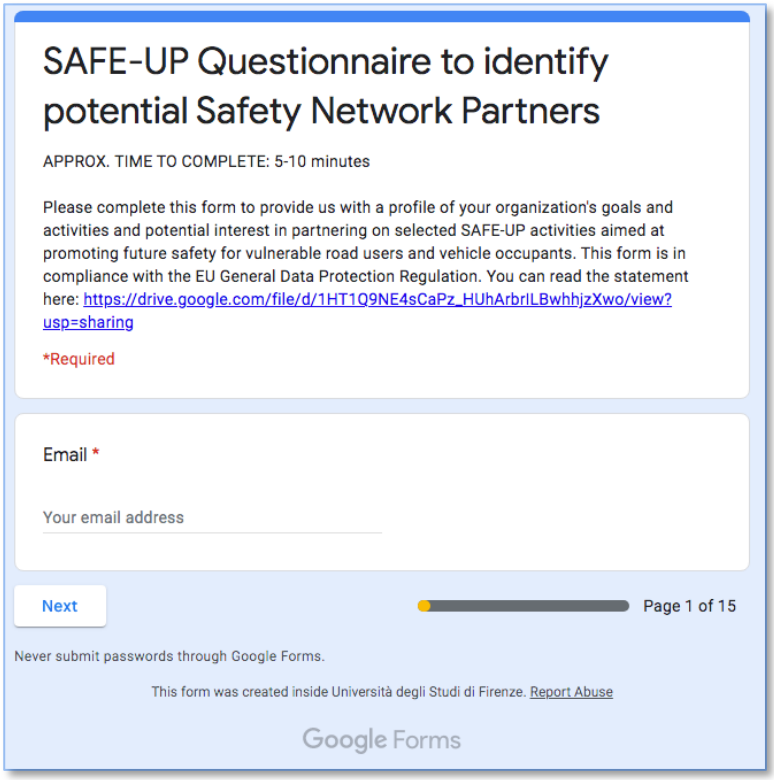

Figure 3.1 Front page of the online form created to identify potential SNPs.

3.1.3.3 Partner role matrix

The partner role matrix (Table 3.2) is used in discussion with Safety Network Partners to determine what roles they would like to play in WP6 activities based on very specific sub-tasks for which their expertise, resources, networks, and so on might be leveraged. These 'Support activities' run horizontally in the matrix in order from very high level, such as input on user needs/safety concerns and interpretation of results, to lowest level involvement such as simply receiving news, updates and outputs. The number of boxes checked, and which end of the horizontal scale is emphasized, then provides a classification of the partner's role as either 'collaborator', 'supporter' or 'recipient' of WP6 outputs. These filled matrices can then be consulted to determine who to solicit when specific types of contributions are sought for realizing KT goals. Note that it was made clear that completing the matrix was an expression of interest in principle and did not, in any way, constitute a binding commitment.

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Table 3.2 Partner Role Matrix.

INSTRUCTIONS

For each numbered section, please check the boxes that apply.
Black check boxes are pre-selected as most likely choices according to the desired level of involvement.
The grey boxes are active and may nevertheless be selected.

Which type(s) of activities would you like to collaborate on or contribute to?

Please choose the level of involvement and the types of activities that would characterize your organization's role as a Safety Network Partner (or Stakeholder).

Participation on an ad hoc basis. To be discussed further and mutually agreed on. Filling this form does not constitute a final commitment.

WP6 Knowledge translation, training and awareness; WP7 Dissemination & Exploitation

SAFE-UP lead & contact:	WP6	WP6	WP6 WP7	WP6	WP6	WP6 WP7	WP6	WP6	WP6	WP6 WP7	WP6 WP7	WP7	WP6 WP7	WP6 WP7	WP7
Support activities:	ID Target KUs	ID future safety priorities	Advisory & Networking	Events & Campaigns	New knowledge products	Inform policy & decision	In-kind support	Language translation	ID Barriers, challenges	Tailoring & Dissemination	Attend SAFE-UP events	Receive technical updates	Receive news, updates, KT	Measure reach & impact	Public endorsement
Role	**Level of involvement**														
Collaborator	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Supporter	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Recipient	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Totals for 4 URU reps All are 'collaborators'	4	3	3	1	3	4	1	2	2	3	4	4	4	2	2

Role:
Collaborator: Participate / collaborate on KT activities & strategies, participate in KTE meetings.
Supporter: Actively share SAFE-UP KT products, news, updates with your membership.
Recipient: Receive news, updates, research results for your own use.
KTE, knowledge translation & exchange.

Space for additional comments, ideas for KT collaboration or ways your organization would like to be involved with SAFE-UP KT & training development:

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3.1.4 KT examples & inspiration

The following are a selection of some KT best practice examples plus sources for inspiration and resources.

What is Knowledge Translation? – video

KT resources

- SickKids® (Toronto Hospital) Knowledge Translation (KT) – site Training & resources
- Innovation York's Knowledge Mobilization (KMb) Unit – York University – site Support for researchers
- Research Impact Academy – site
  Consultancy, free online tools & resources
- Matter of Focus – research impact assessment free tools, consultancy, OutNav software for reporting research impact
- US Government – Plain language writing – webpage

KT examples

- Sprinkles Global Health Initiative – video
- Brené Brown on Empathy – video
- British Heart Foundation – Vinnie Jones' Hands only CPR – video, Mini Vinnie CPR – video

Examples of organizations doing KT for injury prevention & road safety

- Parachute: Canada's Vision Zero program – site
  Education, knowledge sharing, campaigns, etc.
- IFZ Institute for two wheeled safety – site
  Research, evidence-based promotion, education and awareness, resources; research conferences
- ECF European Cyclists' Federation – site
  Evidence-based lobbying and advocacy, promotion, education and awareness, resources
- Living Streets – site
  Evidence-based lobbying, promotion, education and awareness, resources, support for activism

Food for thought

- Know your why | Michael Jr. – video
- Start with why | Simon Sinek – video

3.2 Sources of data and inputs for KT of SAFE-UP outcomes

Figure 3.2 illustrates the flow of knowledge into T6.3 and among the WP6 tasks. Inputs from outside WP6 come from both external (SPN and advisory board – AB) and internal partners and information available in the road safety realm. Note that although the arrows suggest a unidirectional flow, this obscures the non-linear, emergent nature of the work. For example, creating infographics from T2.1 inputs required collaboration with the researchers in multiple

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consultations and draft versions to ensure that nothing was “lost in translation”. After creating a first draft of each infographic they were reviewed together with researches for inputs on understandability, corrections of any misinterpretations, technical clarifications and readability and visual appeal. The materials are shared publicly only upon receiving final approval from researchers who performed the data analyses and prepared the D2.6 deliverable.

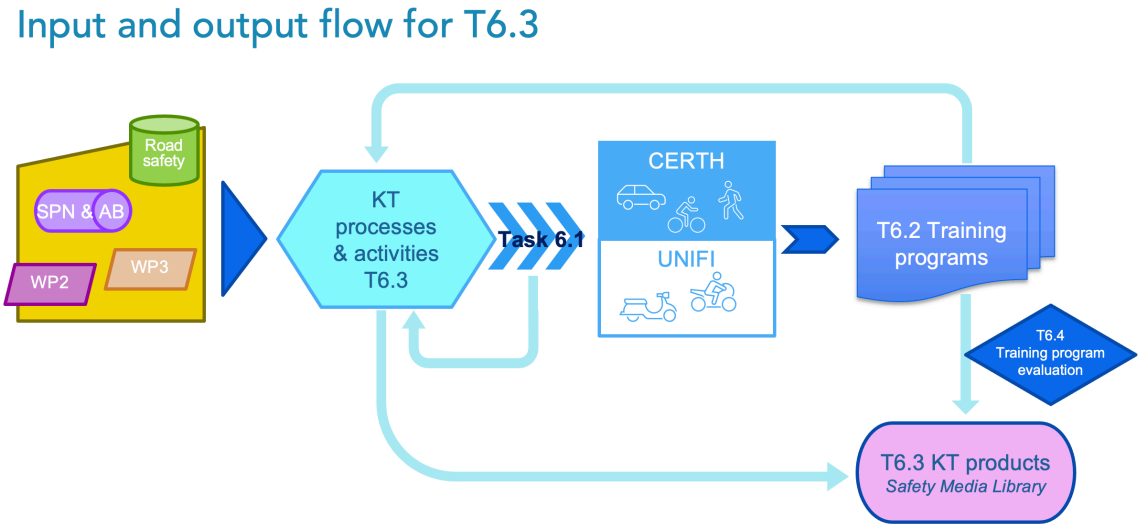

Figure 3.2 T6.3 input and output flow in relation to WP6 tasks and internal and external partner contributions.

3.2.1 Inputs from other work packages

Outcomes from Task 2.1 on current and future safety-critical scenarios in car-to-pedestrian, car-to-cyclist, and car-to-PTW rider crashes have provided the earliest inputs to Task 6.3 and are fundamental to all the technical work packages. An infographic was created to provide an overview for general audiences on the activities of each work package and their use of T2.1 results (see Figure 4.21 T2.1 Early results summary. The results from deliverable D2.6 are available and have been used in identification of target safety themes and translated into initial main messages and TE&A goals for T6.2 and T6.3. Results for Task 2.5 Future safety-critical scenarios are pending later in the project.

D2.6 provides EU overall statistics from the CARE database on car-to-URU crashes, with comparisons of weather conditions, time of day, and infrastructure context. In addition, new results from in-depth analyses using the GIDAS database include crash frequency and injury severity across defined scenario clusters provide insights on the influences of infrastructure (e.g., designated versus non-designated pedestrian crossings), effects of bad weather (relating to visibility of URUs), and behavioural failures of both drivers and URUs as crash causation factors. Analyses of naturalistic driving data provide specific information about behavioural factors in near misses. A summary of the defined scenarios is provided in D6.1

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and full details are available in D2.6 including scenarios targeted to be most applicable for the respective safety interventions being developed in WP3.

Translation of D2.6 results into a variety of infographics and materials as top-level information and awareness for multiple audiences is in progress (see section 4.2.4 for examples). These will comprise the first materials for dissemination which can stand alone and be used as support materials for training programs. In presenting simplified versions of results, they will also be used to facilitate knowledge exchange with SNPs for feedback on relevance and interpretation of results, possible applications and target audiences.

The intention during the second KT cycle is to define new MMs based on the emerging outcomes for future safety-critical scenarios and safety innovations (Demos 2, 3, 4) and either integrate these to update materials created in the first cycle or update with new KT goals, or both.

- DEMO 2: URU detection under bad weather conditions.
- DEMO 3: Integrating advanced intervention functions to avoid critical events.
- DEMO 4: Safety solution based on C-ITS to enable timely warning provisions

3.2.2 Inputs from other WP6 tasks

The activities in T6.1 have provided advancement of the KT plan through identification of priority themes, TE&A objectives and target audiences which are also inputs to T6.2. Materials developed in T6.2 will also become part of the online Safety Multi-Media Library on a dedicated section of the SAFE-UP site.

3.2.3 Partner contributions (SPN & Advisory Board)

This topic is covered in detail, both above in the explanation of partner engagement in Section 3.4, Steps 1-3 of the KTPT description, as well in section 4.1.1 Steps 1-4 Project partners & KT expertise. Briefly stated again, knowledge users are engaged in the interpretation, targeting and tailoring and dissemination of results or implementation of KT strategies.

3.2.4 Organizational Websites

A wide range of organizational websites were surveyed by the T6.3 lead researcher to improve literacy on the relevant themes, initiatives, research directions and issues, roadmaps and literature relevant to future mobility planning and the coming AV traffic and issues for URU safety. In addition, organizations active in knowledge translation (regardless of whether they use this term) and promotion of injury prevention and road safety were surveyed for current best practice examples and aligned themes. Many of these were included in the initial list of potential Safety Network Partners.

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3.2.5 Literature

Familiarization with research on the road safety ecosystem, training, AV research, innovation and implementation issues, and collection of references is ongoing and covers a wide range of related topics including but not limited to:

- AVs, CAVs, CITS research & development, implementation
- VRU safety and AVs
- Knowledge translation and research impact
- Road user behaviour, risk, behaviour change models and theories
- EU Reports & roadmaps for urban mobility, AVs, SDGs
- Driver licensing and education; traffic safety and mobility education in schools

Given the broad scope of relevant fields, it was not possible to do an exhaustive review on all these themes. Focussed literature reviews will be performed where need for 1) research articles submitted to journals, 2) selection of KT strategies and implementation plans.

3.2.6 Online Meetings, Conferences, Training & Webinars Attended

During the first half of the project, the T6.3 leader/researcher attended webinars and online conferences for the purposes of 1) increasing KT capacity and networking, 2) learning more about the current road safety and future mobility realm, key players and themes, 3) collecting data and inputs directly relevant to achieving T6.3 outcomes in particular and WP6 objectives overall. These events are listed in Table 3.3 Online meetings, conferences, training & webinars attended.

Table 3.3 Online meetings, conferences, training & webinars attended.

Type of input	Event	Host / source	Short description
KT Process	Research Impact Summit (April 2021) Webinars	Research Impact Academy webpage	Three-day event involving interviews with leaders in KT. implementation, research impact assessment and knowledge mobilization.
Current EU road safety context	1st EU Road Safety Results Conference – plenary sessions and breakout on Distraction (April 2021)	EC Mobility & Transport - Road Safety Recording	Presentation of the results from the report on implementation of the safe systems approach

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Type of input	Event	Host / source	Short description
Current VRU safety initiatives Networking	Motorcyclists Safety Workshop: Riding in a Safe System -- Opening plenary session (June 2021)	International Transport Forum (ITF) Recoding	Panel to provide recommendations on a wide range of measures to improve the safety of motorcyclists.
Current VRU safety initiatives; Networking	Motorcyclists Safety Workshop: Riding in a Safe System -- Closing plenary session (Sept 2021)	ITF Recording	Panel to provide recommendations on a wide range of measures to improve the safety of motorcyclists.
L SOA Traffic safety & mobility education for children & youth	LEARN! Leveraging Education to Advance Road Safety Now! – Education (June 2020)	European Transport Safety Council LEARN! Project Recording	Key Principles for Traffic Safety & Mobility Webinar: Report on EU status of nations and recommendations
SOA Traffic safety & mobility education for children & youth	The LEARN! Manual Webinar (June 2021)	European Transport Safety Council LEARN! project Recording	New publication sets out eight steps to improved road safety education Inform on new road safety educational development framework

3.3 Creating a KT plan: pathways to impact

Creating an impact plan to 'bring research to life' starts with the question, What do we want to share? What do we hope to accomplish by sharing results? What are our KT Scenarios? For example, we could describe the KT scenario for the results from D2.6 as the following:

> *SAFE-UP has produced new statistical analyses on the most common and serious crashes between passenger cars and VRUs (pedestrians, cyclists, motorcyclists) in the EU using the most currently available data. In-depth analyses (using the GIDAS database) have provided details on the influences of infrastructure, bad weather and time of day, as well as the typical failures and errors made by the respective road users involved. These new details will support the development of active safety systems and intelligent communication solutions aimed to mitigate the chief causal factors and reduce serious injuries and fatalities resulting from car involved*

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crashes. This information can also be used to inform the public and public authorities to contribute to road safety promotion efforts.

There is no one way to do KT of research, nor a one size fits all approach to planning pathways to impact. So much depends on the specific questions, the nature and stage of the research, as well as the state of readiness of organizations, people or contexts to take up and apply the knowledge. The KT approach will also be determined by the specific changes that are desired as impactful outcomes.

In Europe, KT is more commonly known as *pathways to impact*. Figure 3.3 illustrates the logic flow in planning a pathway from research to impact. A pathway to impact is a plan created at the stage of developing or initiating a research project and outlines how results will be implemented and how impact will be measured. In simple terms it can be thought of as a logic structure: output (research results) + next knowledge users → outcomes → impact. We chose to apply the KTPT© [8] for the basis of the SAFE-UP KT plan. As a targeted dissemination framework [6] the template aligns well with the primary communication and educational goals of WP6.

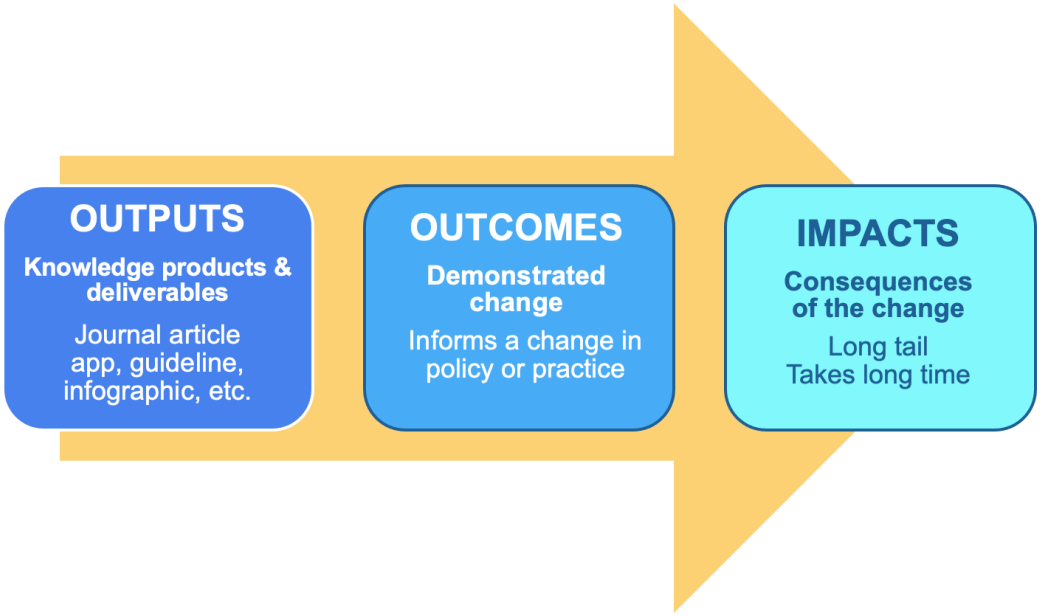

Figure 3.3 Logic structure from research to impact. Adapted from: [30].

The first use of research results can be thought of as *early* KT or early impact, such as basic research informing ongoing research through a journal publication or conference presentation. Or it could be infographics designed for general audiences, for example. Later outcomes include documentable changes in policy, adoption of innovations, or change in practice or behaviour. Impact is what happens as a result of these change outcomes and is measured at the level of the user [30]. Impacts could be negative as well as positive. Or,

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there could be no change, which is also important information to inform the next cycle of research or future projects. True impact takes a long time to manifest (for SAFE-UP, years after project end), but we can start thinking early in the project about how to plan for impact and put tracking and measurement strategies in place.

3.4 The Knowledge Translation Planning Template©

Knowledge translation was chosen as the theoretical basis and practice approach to realizing WP6 objectives. The framework selected to guide WP6 methodology is the Knowledge Translation Planning Template© (KTPT© [8]) produced by the SickKids® Learning Institute of the Toronto Hospital and freely available from their website. The Learning Institute's Knowledge Translation (KT) Program hosts three training workshops for internal and external participants and offers a variety of tools and resources. The KTPT© identifies the core components of Knowledge Translation in a structured approach to planning for research dissemination and impact, both in academia and beyond. This section describes the components of the KTPT to be considered in creating a KT plan. The SAFE-UP evolving KT plan is presented in Section 4.1.

Steps in the KT Plan (Source: KTPT© [8])

1. Project Partners
2. Degree of Partner Engagement
3. Partner(s) Roles
4. KT Expertise on Team
5. Knowledge Users
6. Main Messages
7. KT Goals
8. KT Strategy (s)
9. KT Process
10. KT Evaluation
11. Resources
12. Budget Items
13. Implementation (of the KT plan)

Additional materials to support use of this tool are an eLearning Module, *How to Prepare a Knowledge Translation Plan* [31], a reference guide, *Using the Knowledge Translation Planning Template*© [32], and The KT Game© [33]. Section 3.2 below briefly describes the different KT components outlined in the KTPT©. Figure 3.4 shows a simplified version of the SAFE-UP KT plan to easily visualize WP6 objectives and overall workflow. Note that despite the stepwise structure, following a KT plan is not a linear process [34]. Different phases of the plan could be operational at the same time [34]. For example, one KT product may be at the evaluation stage while other KT goals and strategies are just being determined. Engagement with partners on one initiative may be advanced and well established, while new partnerships are just being established and mutual interest in initiatives are in the

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discussion stage. Checks need to be made forwards and backwards to assess alignment and progress and adjustments made where and when needed.

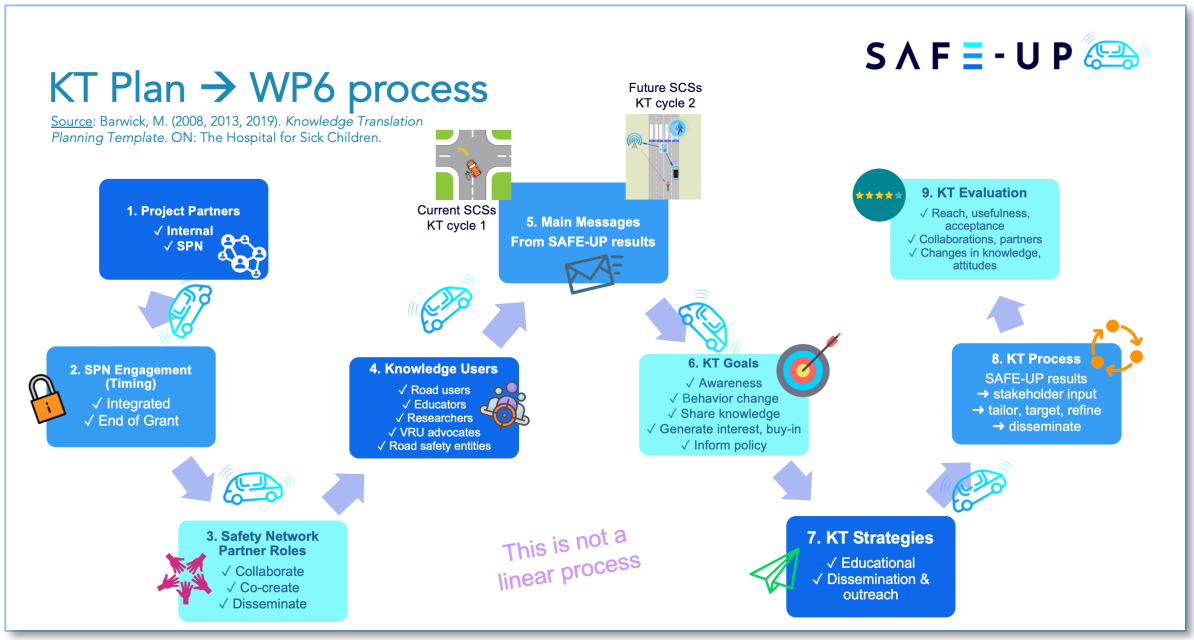

Figure 3.4 simplified version of the KT plan as process methodology for WP6 (T6.3).

Step 1: Project Partners

Before a project begins it is important to identify both *who can help* to ensure success of project aims and *who will be impacted* by the outcomes.

To plan for maximal impact through uptake of project outcomes, it is important to think beyond other academic audiences or researchers, and to potential partners whose expertise, resources and networks could benefit the project aims.

Potential partners (Adapted from: KTPT© [8])

- Researchers
- Practitioners/service providers
- Public
- Media
- Patients/consumers
- Decision makers
- Policy makers/government
- Private sector/industry
- Research funders
- Volunteer road safety sector/NGO
- Other

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2Step 2: Degree of Partner Engagement

"People want to feel involved in the process of discovery and interpretation and are more receptive to research findings when engaged early on."

- Dr. Melanie Barwick, implementation scientist, SickKids® Learning Institute [31].

The timing and degree of partner engagement depends on the KT goals, project activities and timeline for emerging results. Partner engagement may follow *integrated KT* – initiating at or after project creation and running through the life of the project. Many funders now require that knowledge users be involved in the planning and development of your grant proposal. In *end-of-grant KT*, partners are engaged at the point of dissemination or after project end.

Partners may be highly engaged early on, being involved with formulation of the research question and data collection (engaged research), or in interpretation of results and co-creation of new knowledge. They may be less engaged and towards the end of the project, assisting in dissemination of or just receiving outcomes end-of-grant. Different partners may be engaged at different times and to different degrees throughout the project, depending on their role and the sequence of activities.

Best Practice says to engage knowledge users throughout your project and the earlier the better [for example, 15, 19]. This is also often a requirement of funders. Project partners will likely be among your target knowledge users. By engaging with partners who have knowledge and contact with intended audiences, researchers can benefit from their experience though contributions and feedback on how to present the knowledge, evaluate its use and relevance, find and/or record other kinds of needed evidence [6] (including specific user characteristics and needs). Giving knowledge users a voice in how results are interpreted and utilized helps to ensure acceptance, uptake and sustainability of the outcomes. Leveraging partners' expertise, activities and networks can help to maximize dissemination and impact, especially if project resources for these activities are limited.

Step 3: Partner(s) Roles

Partner's roles should be agreed on and defined in the KT plan. It is important to consider not only what we wish partners to bring to the table but to understand what they hope to gain by their involvement. Expectations of partners' roles and level/type involvement should be clearly stated. For Best Practice a Memorandum of Understanding should be created, outlining these details [31].

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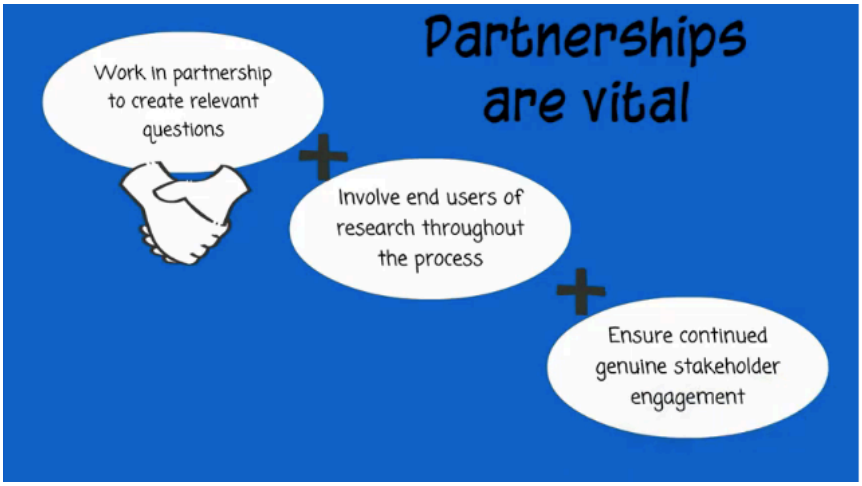

Figure 3.5 A KT fundamental: Partner engagement. Source: [10] with permission.

Step 4: KT Expertise on Team

In assessing the requirements and scope of KT activities, it is important to consider what KT expertise will be required to realize the activities. Depending on the KT goals and existing expertise on the team, specific gaps in needed skills or experience may require hiring or sub-contracting of necessary personnel.

Step 5: Knowledge Users (KUs)

"Who needs to know about what you have learned?
Who is going to be interested in your research findings?
Who will value this research knowledge?
Keep in mind that a knowledge user audience can, and likely will,
overlap with your project team and project partners."

Dr. Melanie Barwick [32, p.4]

Best Practice underlines the importance of including knowledge users on your research or project team [31]. This relates to Step 1: Stakeholder Engagement.

Types of KUs to consider (Adapted from: KTPT© [8])

- Researchers
- Road transport & safety Practitioners
- School boards, Educators
- Driving schools, driving instructors
- Public
- Media
- Consumers
- Decision makers

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- Policy makers/government
- Private sector/industry
- Research funders
- Volunteer URU & road safety sector/NGO
- Other

Step 6: Main Messages

"A well-written main message is a clear, concise and audience-focused statement."

Dr. Melanie Barwick [32, p. 5]

Main messages (MMs) are not simply data or findings but are interpretations of what the research results *mean*, why they are important and what action(s) should be taken as a result. What do we want to say about our results and outcomes and why? These messages can be about what we learned or what we *anticipate* learning. A useful tip for crafting main messages is to think in terms of the SMIT or BLAM [6] (see Figure 3.6).

After determining the overarching main message, a best practice is to frame research outcomes to address each knowledge user group's interests and needs [31, 7]. By developing targeted and tailored MMs to address the perspectives and context of each KU group, the same evidence may be interpreted as a different main message for each knowledge user or road user group.

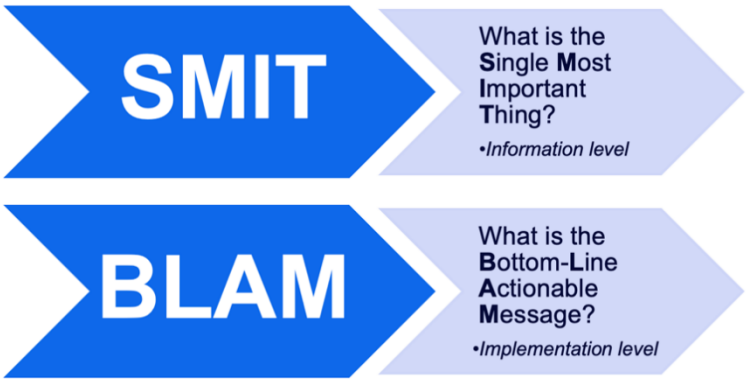

Figure 3.6 Crafting a main message. Source: KTPT©

It can be helpful to ask questions like, What will the KU group consider to be the most relevant and important results or developments? Importantly, this may not be the same as what the researchers considered most important and may be directed towards very different applications than was originally intended as part of the project objectives. In responding to the results, Do KUs have additional questions that can be incorporated into the research and analysis?

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Step 7: KT Goals

"Being clear about why you are communicating your research findings is central to effective KT." [32, p. 5]

In considering the knowledge translation goals, we can ask, *what do we hope to accomplish by sharing results?* If our intent is to share research knowledge, even if results are not ready for application, we can inform others so they know what we did, or have learned so far.

Ideally, we would like to translate results into actionable messages with the potential to effect behaviour, policy or practice change. Remembering that KT focusses on sharing knowledge through targeted dissemination strategies, any goals for practice or behaviour change would require their own implementation plans.

Possible KT goals [8]

- Generate awareness, interest, buy-in
- Impart knowledge, tools, skills
- Generate public action or behaviour change*
- Generate practice change*
- Inform/improve decision-making
- Inform research & researchers
- Facilitate policy change
- Facilitate commercialization/technology transfer*
- Other

**These KT goals will require separate implementation plans.*

Step 8: KT Strategy(s)

"Multifaceted/combined KT strategies are more effective than single strategies." [31]

Numerous strategies are possible, ranging from peer-reviewed journals to infographics or 'infomations', to webinars, educational programs, arts-based KT, or mass media campaigns. Where possible, the strategy considered should be based on evidence showing its effectiveness for your target audiences and KT goals. Each potential strategy must be evaluated in light of the target audience's context and characteristics. Figure 3.7 illustrates how MM, KU and KT goal must be considered together when selecting the KT strategy. It is also important to identify possible barriers for your KUs to access the information, or barriers to acceptance. In selecting strategies to achieve the KT goals we must also consider what is feasible given the scope and timeline of the project, resources (budget and expertise) and balance this against identified TE&A priorities (see D6.1).

The KTPT© provides examples of KT strategies that are grouped according to demonstrated effectiveness in mobilizing clinical research evidence as health care practice change [9]. La Rocca et al. (2012) [35] provide a systematic review on the effectiveness of knowledge translation strategies used in public health.

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Figure 3.7 Selected KT strategies must align with KU needs and characteristics, specific MMs and desired KT goals.

The following organizations are two sources for plain language synthesis and systematic reviews of research evidence in healthcare and social science to inform decision-making:

- Campbell collaboration – https://www.campbellcollaboration.org
  - Road safety review
- Cochrane collaboration – https://www.cochrane.org
  - Road safety review

A Best Practice tip [31] is to assess how your knowledge users prefer to receive information and where they are flocking to access similar information. Some possibilities are:

- Websites
- Face-to-face or personal contacts
- Through opinion leaders, influencers
- Publications – peer-reviewed, white & grey literature

Other research fields for possible references to support KT strategy selection for road safety innovation are:

- Risk (general) & road risk behaviour research
- Organizational health & safety research
- Behaviour change theories and models

Behaviour change goals require separate implementation plans that include selection of the alignment with behaviour theory (see *Step 13: Implementation*). This is echoed in a recent review on best practice in mass media campaigns for road safety [36].

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Step 9: KT Process

Specifying the KT process includes determining *when* knowledge translation will occur (within the project timeline), and *how* it will be carried out. For example integrated KT might involve collaboration between researchers and knowledge users to shape the process as the project evolves, or delivering the knowledge materials at the end of the project, or a combination of the two approaches. The KT process chosen should support the KT goals and the context of the project.

Step 10: KT Impact & Evaluation

> *"**Impact is a function of non-academic partners not researchers**. Researchers don't make products, business partners do. Researchers don't develop public policies, government partners do. And researchers generally don't deliver social services, community partners do. Non-academic partners use the research evidence to inform products, policies and services that then have an impact on the lives of end beneficiaries. Therefore, **to collect the evidence of impact you need to ask the non-academic partner not the academic researcher**."*
>
> *David Phipps, Executive Director, Research & Innovation Services, founder of the Knowledge Mobilization Unit at York University.* [21]

How will we know if we achieved our goals?

The KT process is non-linear, requiring iterations and updates after asking if each KT goal was accomplished with the strategies employed or if the plan should be modified. Were the activities and strategies effective? Well-received? It is important to determine in advance how the KT goals and plan will be evaluated and to ensure this can feasibly be done considering available time and resources within the project.

The evaluation plan should consider the areas of desired impact, such as practice, policy, research or adoption. Bear in mind that the more KT goals, the greater the evaluation efforts required. Success and impact indicators should be identified from the beginning and collection process put in place early on to facilitate this process. The KTPT© [8] and the eLearning module *How to Prepare a Knowledge Translation Plan* [31], list a range of potential indicators that can be used to capture use, usefulness, reach, capacity-building and practice/behaviour change (refer to [8] for details on specific indicators and measures).

Importantly, KU partners should be consulted about what they consider to be important indicators and should be involved in the evaluation process. KT evaluation is a valuable way to capture the impact of the knowledge translation produced and can also help to refine KT strategies for the future. This information could be presented in a publication and is also valuable to researchers for academic CVs and career performance evaluations.

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Step 11: Resources

What resources are required to achieve the KT plan? [8]

- Governing board
- Financial
- Technology
- Staff, volunteer
- Management
- Leadership
- Expertise
- Other

Step 12: Budget Items

Any proposed KT activities must include all the associated potential budget items. This step can refer back to the other sections of the completed plan to consider all possible costs relating to, developing and supporting partnerships, resource requirements, and KT strategies, communications and deliverables. At this stage in the grant, we cannot add new budget items, however, completing this step will be useful for assessing feasibility of KT goals and strategies.

Step 13: Implementation (of the KT strategies)

This step describes the procedures and methods necessary to realize the KT strategies. For example, to implement an online training activity as a KT strategy, you would specify the goal of the activity and how it will be evaluated. Additionally, who will create the module, how it will be accessed, how it will be advertised and shared and to whom, what technological and human resources support will be required? It is very important to describe how integrated KT will be carried out: How will the specific knowledge users be engaged and how will the collaborative support and relationships be maintained?

Depending on the KT goal, this step may require an in-depth implementation plan utilizing change, adoption and behaviour change models from implementation science. Practice and behaviour change goals require separate *implementation plans*. Implementation is defined as, “The use of strategies to adopt and integrate evidence-based interventions and change practice within specific settings” [6]. Targeted dissemination aims may be to share knowledge, generate awareness and buy-in and inform policy and decision-making. In contrast, if the goal is for a change in behaviour (e.g., of road users) or practice (e.g., changes in driver training and testing procedures or changes in how road users (inter)act in traffic), an implementation plan is essential to ensure the knowledge or intervention being transferred “retains its quality, is implemented with fidelity, is sustainable beyond the life of the grant.” [32, p. 8]. For example, an implementation plan for putting a new training intervention into practice could include training sessions to support educators in using/adapting the programs or monitoring and evaluation processes to ensure fidelity in the adaptation of the content and training activities to local contexts.

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Figure 3.8 KT and Implementation are related but not synonymous. Source: [6].

The National Implementation Research Network (NIRN) provides literature and practice resources for KT and Implementation practitioners on their website, including a synthesis of the literature on the science of implementation for transmitting innovative programs and practices to health and social services and education [37]. Another valuable resource is the behaviour change wheel [29] (Figure 3.9) which provides a method for designing behaviour change interventions based on a synthesis of 19 theories and models of behaviour change.

Final words about the KT plan

A KT plan is not meant to be created by a single researcher in isolation [6]. Involvement by project partners to refine the elements will go a long way to ensuring its effectiveness. All the aspects should be checked (and rechecked during implementation) to ensure they are aligned, feasible and that the plan is progressing as intended [6]. Regularly checking and updating allows flexibility and timing for any necessary adjustments.

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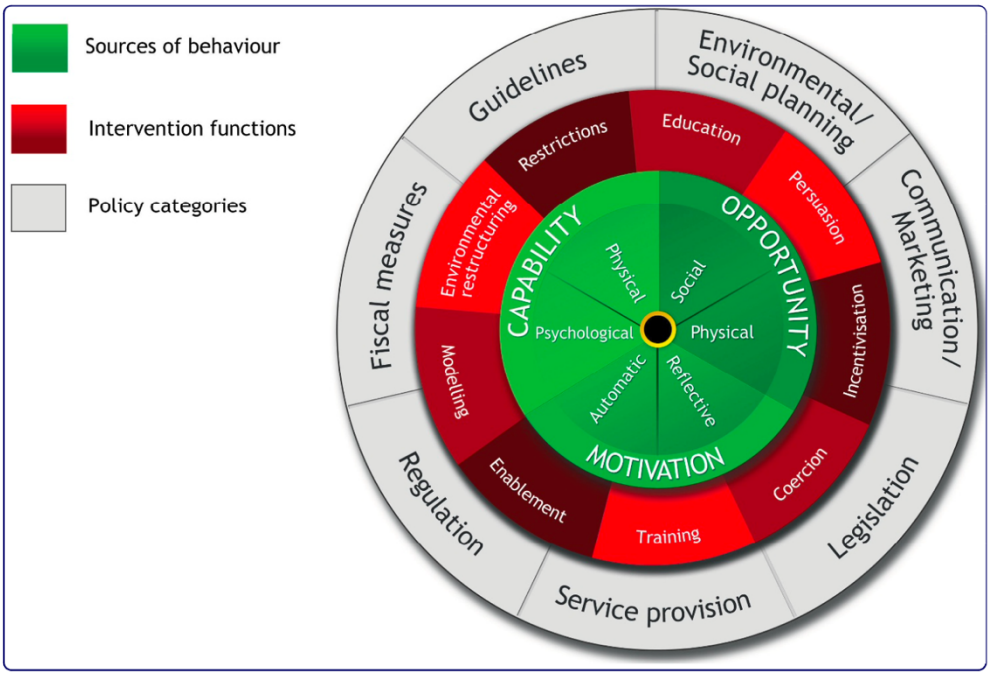

Figure 3.9 The Behaviour Change Wheel [29] is a tool based on the classification and synthesis of 19 frameworks, to use in designing interventions.

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4. Outcomes and Status

4.1 SAFE-UP evolving KT Plan 1st cycle

In the following sub-sections, the SAFE-UP initial KT plan is depicted in graphical slides with accompanying explanations of the choices made for each component/step, and descriptions of activities already carried out. Note that for steps 5 through 10, ONE main message and THREE main KUs have been chosen to illustrate steps of the plan. Similar details must be itemized for each main message, but in the interests of space and to avoid repetition they have not all been provided in graphics form. A condensed table of the KT plan steps 5-8 for was provided in D6.1 for initial (1st cycle) main messages to define TE&A objectives determined T6.1. An excerpt from that table is provided as an example in section 4.2.2.

4.1.1 Steps 1-4 Project partners & KT expertise

Project partners – Building the Safety Partner Network

Taking inspiration from some guiding questions posed in the KT Game© [33, p. 65] we ask: Who needs to be actively involved in the development of TE&A objectives and strategies? Who needs the information on SAFE-UP's main safety and innovation messages? Who can leverage the outcomes on safety-critical scenarios and safety innovations to promote URU safety? In light of WP6 objectives, entities considered included industry (motor vehicle manufacturers and providers of CITS solutions), road safety and transport ministries and NGOs, educators and practitioners (school boards and driving schools, associations) and charity organizations representing the needs and concerns of URU groups.

As one of the initial tasks, a list of 49 potential partner organizations was derived from web searches and recommendations from SAFE-UP internal partners and advisory board. The search targeted (i) non-profit federations of associations promoting the interests of pedestrians, cyclists, and PTW riders; (ii) road safety and behaviour research groups; (iii) governmental and NGO road safety and vehicle testing organizations and research networks; (iv) motorcycle and ITS industry stakeholders, and (v) charity organizations dedicated to accident and injury prevention. Determinations of the types of partners sought are listed in Figure 4.1, step 1.

Partner Engagement

For the purposes of WP6, the KT plan is being applied to facilitate realization of the objectives and was not created as a required part of the grant proposal. In the case of SAFE-UP, all the project objectives and research questions were determined before the project began and without the input of external partners. Although, partners were engaged after idea formulation, engagement (Figure 4.1, step 2,) will continue throughout the life of the project, as *integrated KT*.

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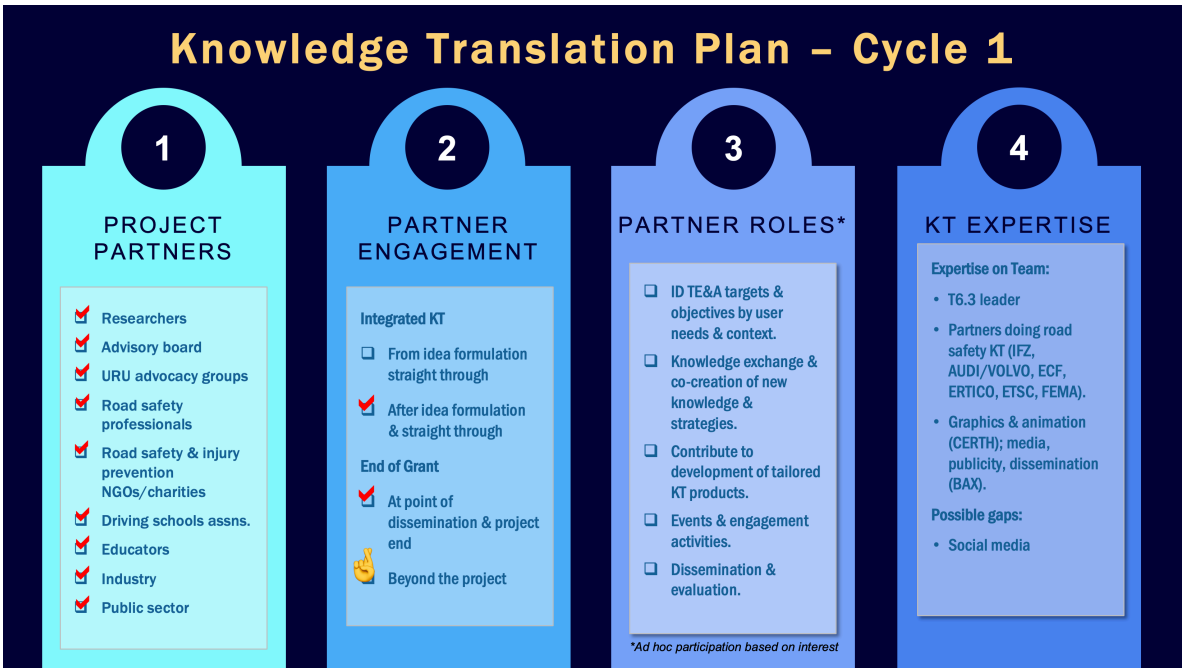

Figure 4.1 KT Plan steps 1-4.

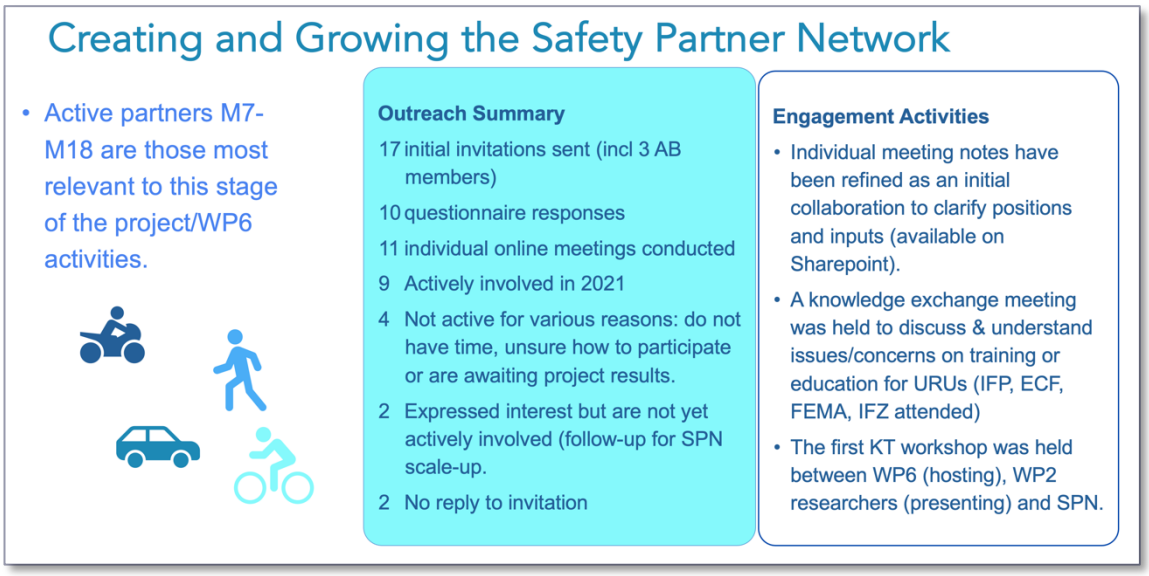

Figure 4.2 Figure 4.2 Outreach and engagement activities as of Dec. 2021.

Engagement process

The initial objective was to strategically engage an initial small representative group of organizations with the greatest interest and understanding of URU needs and begin building sustainable relationships with these. To target the most relevant organizations first, the 49 organizations on the list were ranked according to the key shown in Table 4.1. Of these, 17 were selected as first priorities for engagement, and Initial email letters were sent

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announcing SAFE-UP and describing the project. A couple of months later a follow-up email was sent describing the activities and aims of WP6 and inviting participation in the ad hoc Safety Partner Network which would provide their members with a voice in the interpretation and application of results and exploring collaborative opportunities for mutual benefit. Figure 4.2 summarizes the outreach and engagement activities carried out from M7 to M18.

Interested parties were invited to complete an online form, the *SAFE-UP Questionnaire to identify potential Safety Network Partners (SNPs)*. This tool was created to collect details on each organization's interests and activities, areas of alignment with SAFE-UP/WP6 objectives and potential interest for collaboration and exchange activities. Slides from the questionnaire in Figure 4.3 to Figure 4.12 show the key questions and summary results.

Table 4.1 Ranking key for identifying potential project partners.

Ranking	Identifiers – organizational objectives and activities
HIGH = 1	• Those whose missions and activities promote or directly impact VRU safety or represent URU needs and interests, and/or who are active in advocacy and informing policy. • International and European-level for top-down representation and dissemination contribution which can be later scaled up and diversified through their member organizations.
MED/HIGH = 1-2	• Those whose research directly concerns improving road safety. • These are considered medium or high depending on directness of access to/for URUs.
MED = 2	• Those who include URU safety amongst stated important road safety/injury prevention themes (i.e. not the sole/main focus of the organization).
LOW = 3	• Those whose focus is related to transport but not directly on promoting current or future safety. • End users, to become high priority towards the end of the project when TE&A materials are ready for public dissemination.

After each representative completed the questionnaire, initial one-on-one interviews were conducted between representative and the T6.3 researcher. SAFE-UP objectives and WP6 activities were described in more detail. Interviewees were questioned about (i) activities and mandates of the organizations, (ii) perspectives on automated driving functions and AV traffic, (iii) CITS for VRUs through wearables, and (iv) the role of training, education and awareness currently and in future traffic contexts. Some of the representatives expressed uncertainty about alignment of WP6 objectives with their current activities and/or stated they could not take an active role but would look forward to updates and project outcomes. Representatives who expressed an interest in active involvement also review a detailed

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checklist with the researcher to determine their ad hoc role with respect to *potential* (ad hoc) involvement in specific WP6 activities. This form was completed online in discussion with the WP6 researcher and does not represent a binding commitment.

For groups that showed an active interest in continuing engagement, meeting notes were elaborated and then shared with the interviewee, who also contributed clarifications, edits and responses to requests for more detail or explanations and references. Through this co-editing process, information from the partners was expanded and clarified. Permission was then requested and gained for sharing the notes with other Safety Network Partners and with SAFE-UP consortium partners.

Because of concerns expressed about the appropriateness of training for pedestrians and cyclists, a group meeting was held with representatives of the URU groups to discuss acceptability or non-acceptability of training versus educational or awareness raising approaches for VRUs. A Knowledge Translation and Exchange workshop was held between T2.1 researchers, WP6 and available members of the SPN with the aim to share results from D2.6 on initial safety-critical scenarios and receive feedback on relevance and usefulness to their members and target audiences. Before the workshop, the 4 external attendees were asked to sign a Memo of Understanding outlining their agreed on roles as ad hoc members of the Safety Partner Network. The MoU also included a non-disclosure agreement as the project results shared were not yet approved for public dissemination.

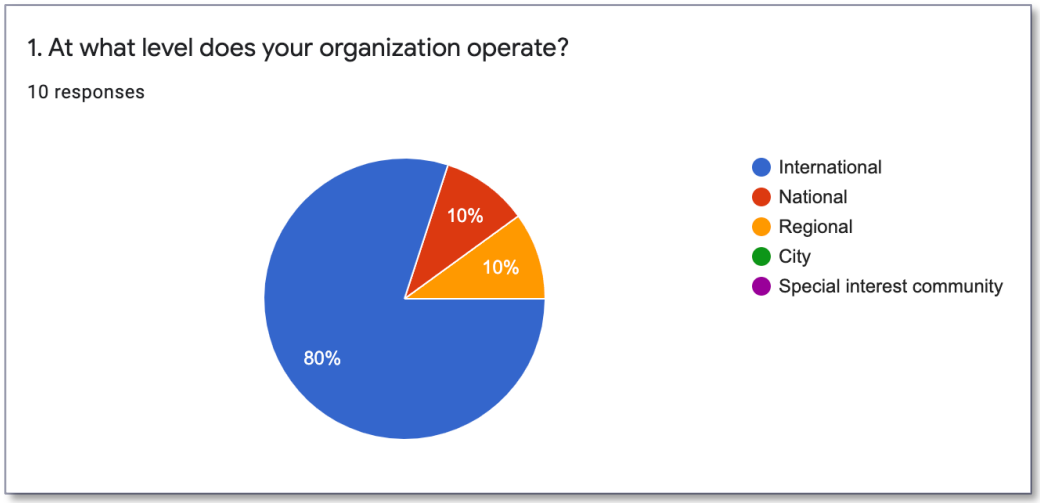

Figure 4.3 Question 1. Organizational level.

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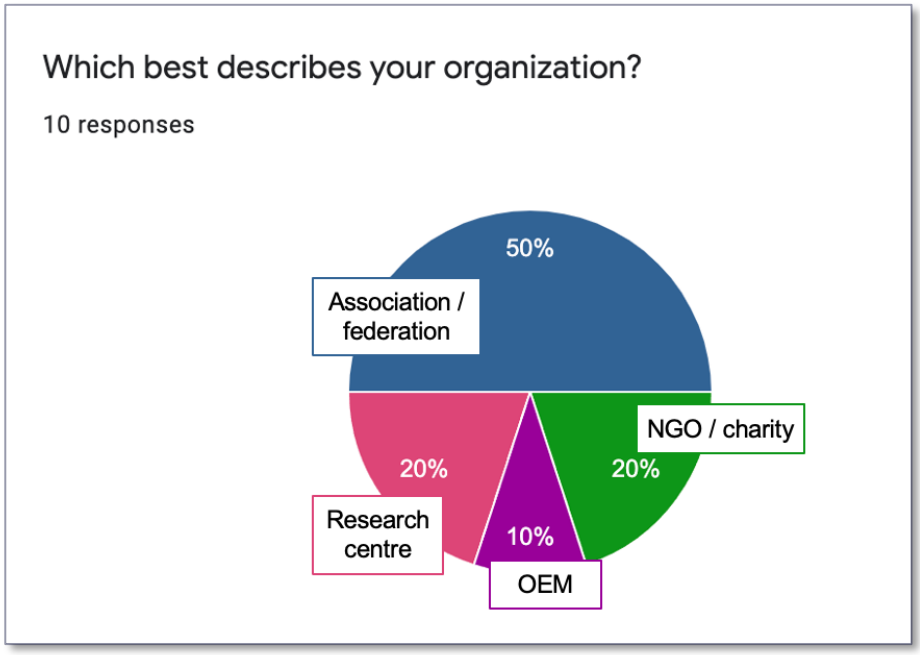

Figure 4.4 Question 2. Type of organization.

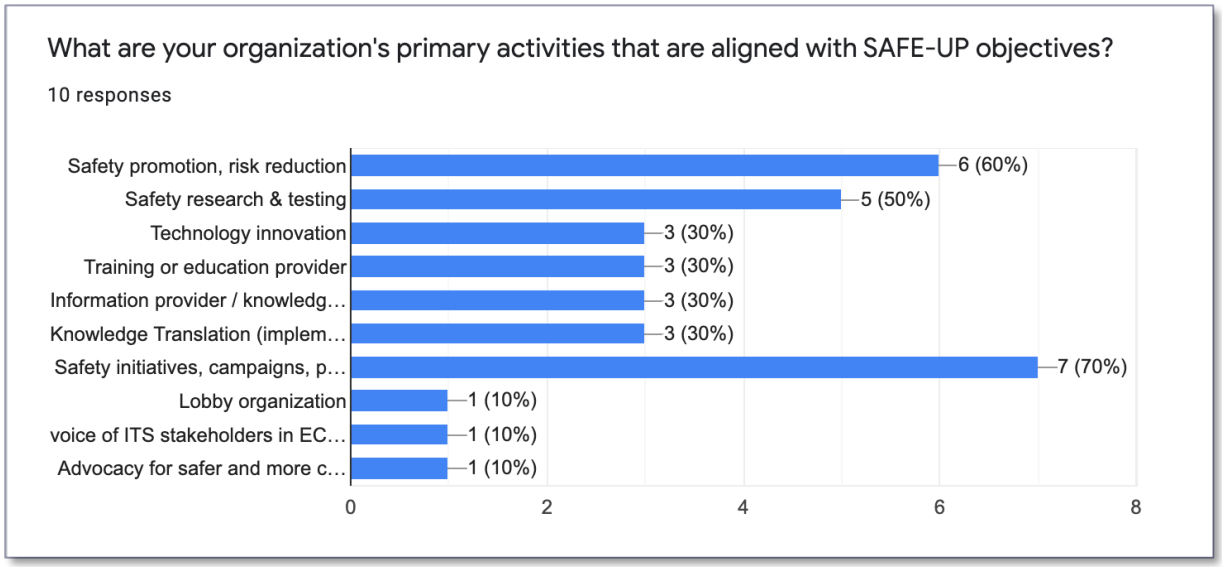

Figure 4.5 Question 3 Organization's primary activities that are aligned with SAFE-UP objectives.

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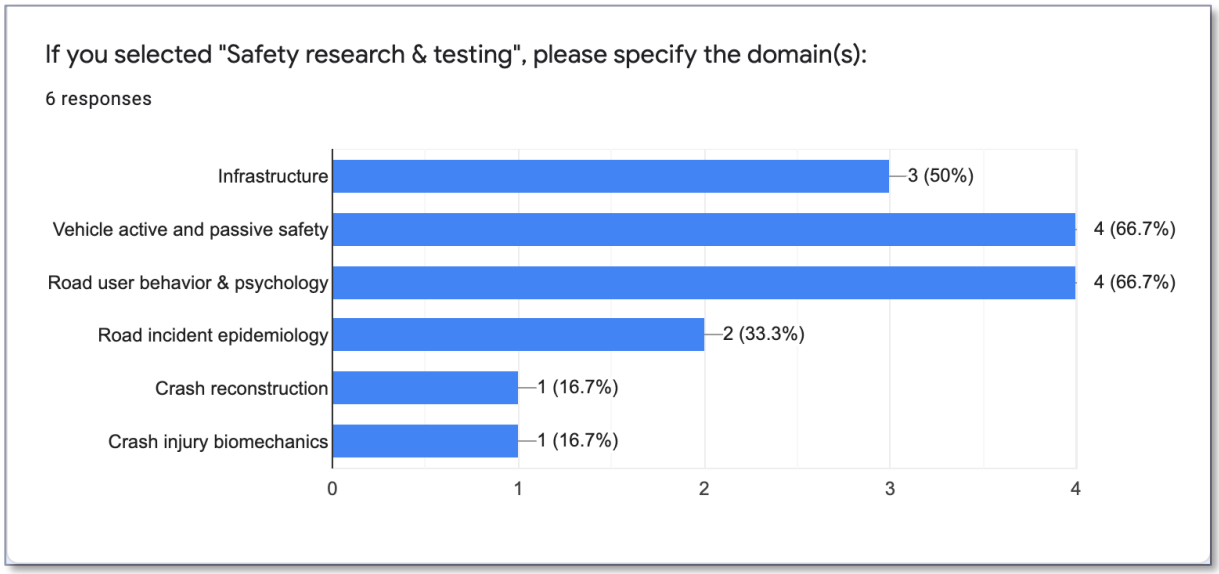

Figure 4.6 Question 3.a In which domain(s) in 'Safety research & testing' is/are the primary activity(s)?

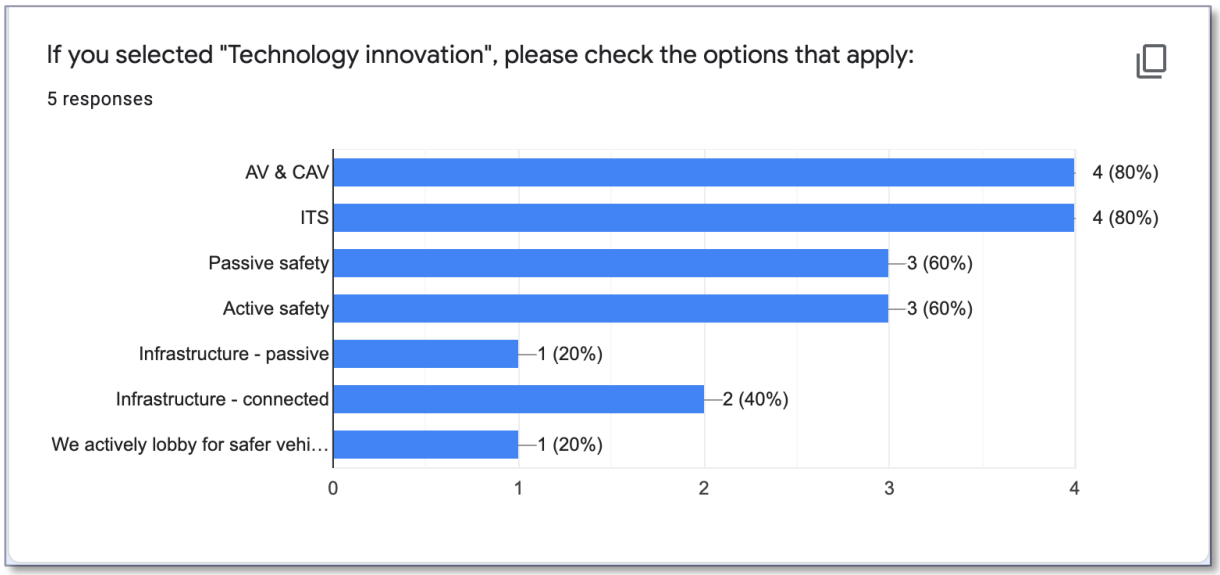

Figure 4.7 Question 3.c In which domain(s) in 'Technology innovation' is/are the primary activity(s)?

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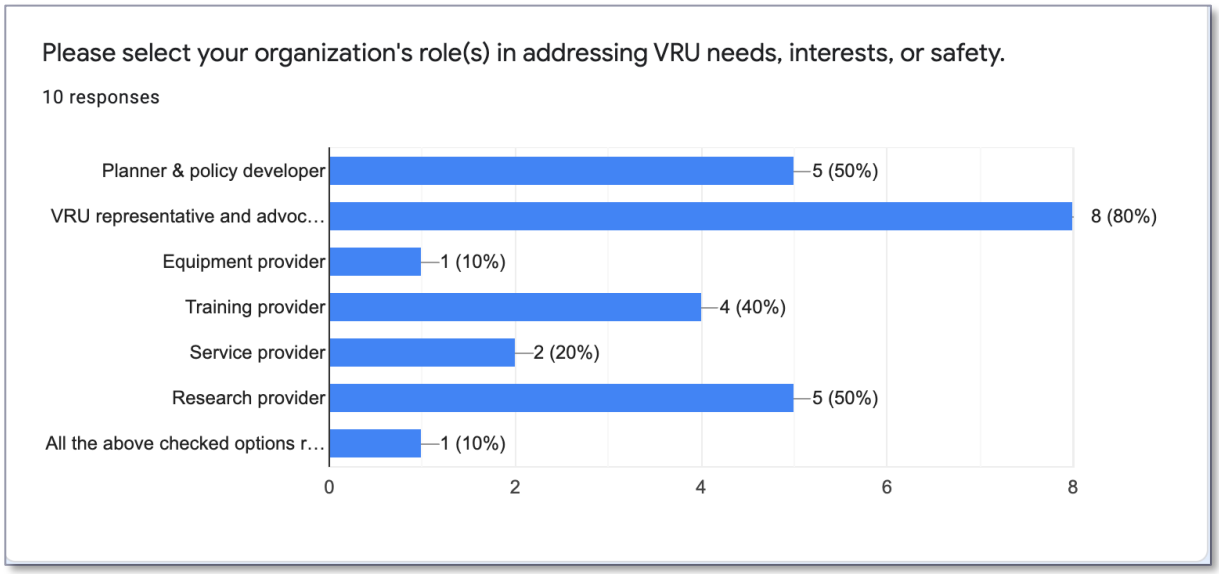

Figure 4.8 Question 4 Organization's relevance to URUs.

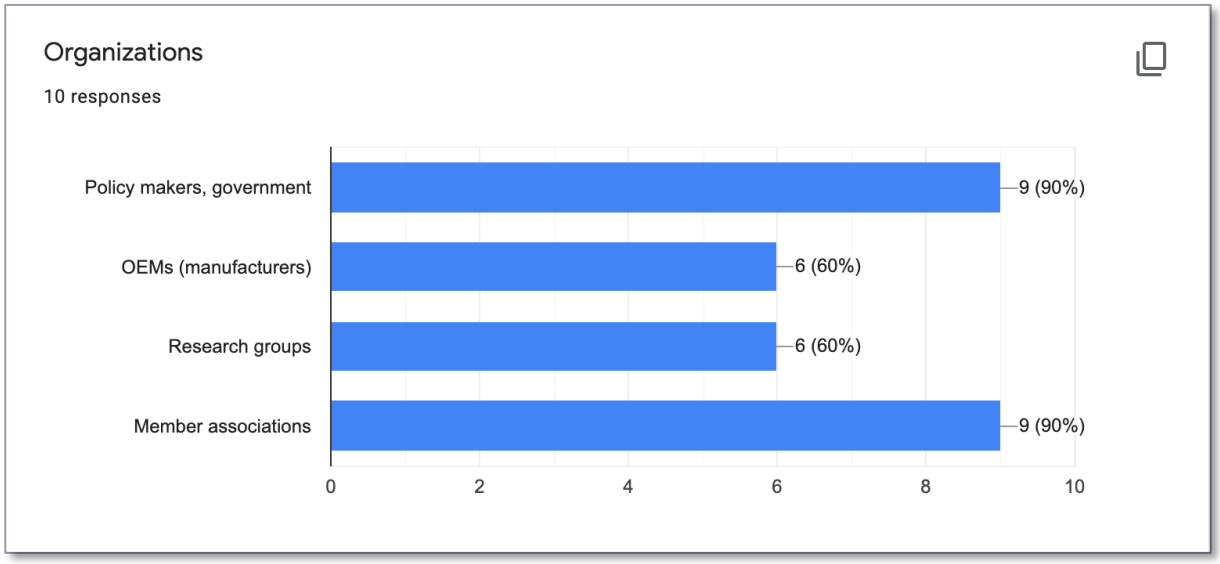

Figure 4.9 Question 5.a Target audiences – organizations.

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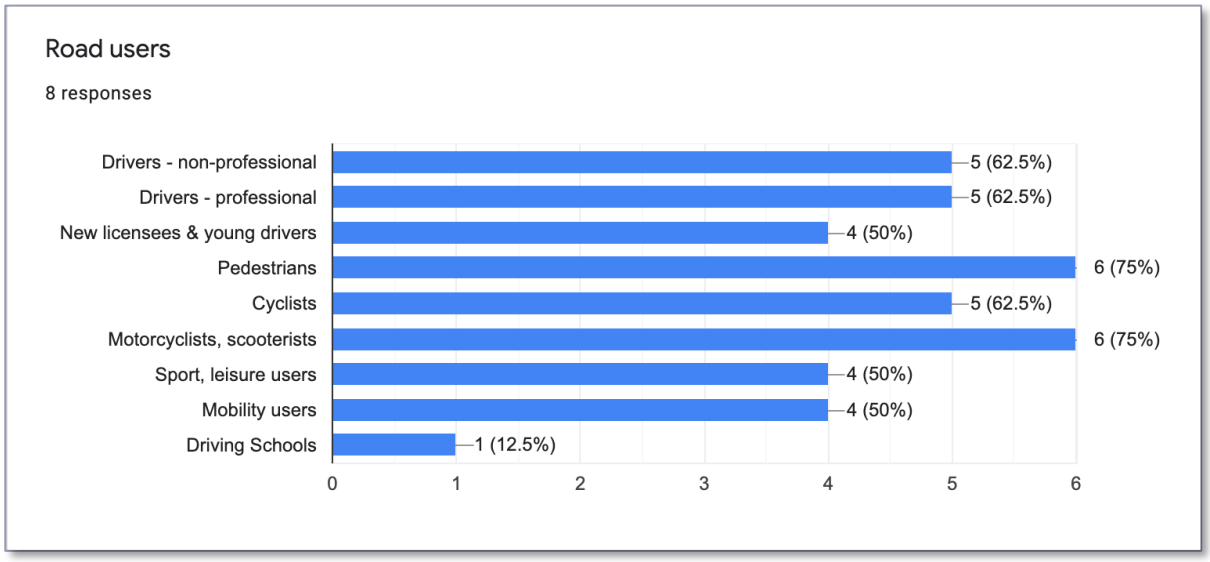

Figure 4.10 Question 5.b Target audiences – road users.

Partner roles

The types of contributions and involvement sought from SNPs to facilitate WP6 objectives, are listed in Figure 4.1, step 3. Figure 4.11 shows the summary responses from the question, "Which SAFE-UP training and awareness activities would you like to collaborate on or support?" The options were to select any of the following:

1. Identification of future safety priorities & training/awareness objectives - by user needs / context.
2. Knowledge exchange & co-creation of new evidence-based safety information & strategies for uptake.
3. Contribution to the Safety Information Multimedia Library: development of materials (infographics, animations, gifs, infosheets, pamphlets etc.) tailored for different target audiences.
4. Coordination of events, engagement & outreach activities.
5. Sharing and dissemination of material from the Safety Information Multimedia Library.
6. Other?

The favourable responses to items #1 and #2 were exactly in line with our priorities for the types of involvement sought for the initial phase of activities towards knowledge exchange for developing TE&A outputs that are needed, relevant, targeted and tailored for specific audiences. Items #3 and #4 were considered more a "wish list" of in-kind contributions considering our limited resources, but in any case, are more relevant later on during the KT strategies development. Similarly, the dissemination function (#5) is important but refers more to activities that are longer tail and can be reassessed and

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addressed through scaling up activities of the SPN when materials are ready for sharing. An important difference between the advisory board and the Safety Partner Network is that the AB members all signed letters of support for the project and its aims whereas representatives of the pedestrian and cyclist groups show caution about showing general support, since the project aims may not be exactly in line with their primary goals – those being to motivate more active mode use as 'more desired' mobility modes, to remove road danger, and address barriers to active mode adoption by citizens. Thus, there is more of a 'wait and see' response from these groups regarding SAFE-UP intended outcomes. Inn parallel, there is an active interest in taking part to share the knowledge and points of view on URU concerns and issues with regard to traffic safety and proposed interventions, and to be updated on these developments.

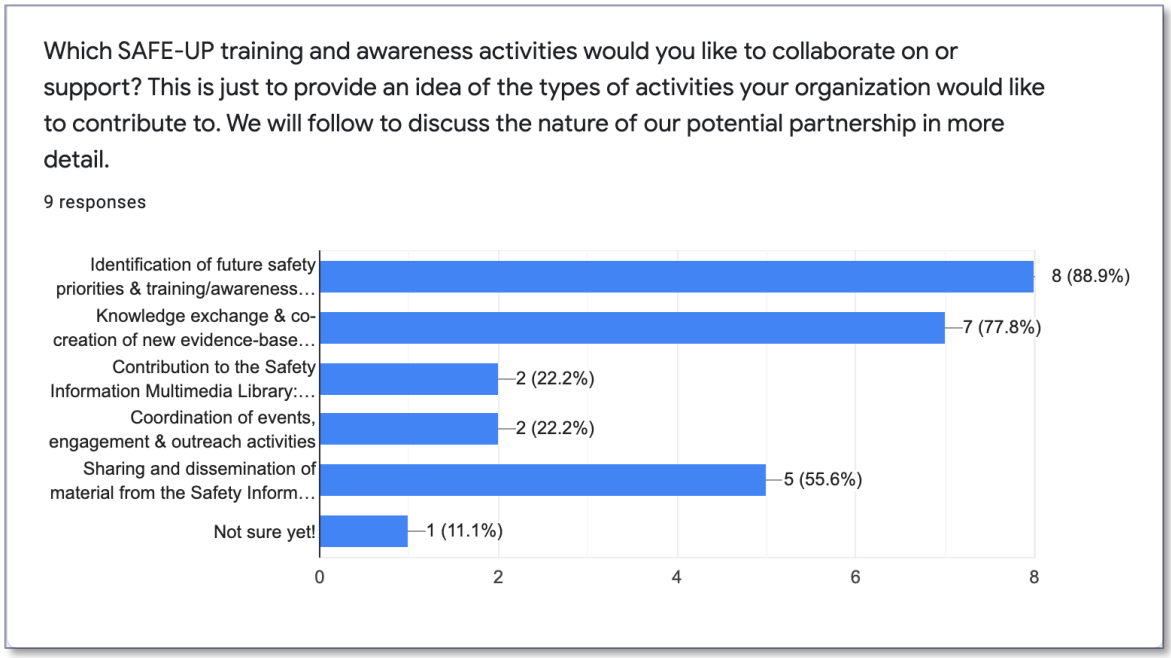

Figure 4.11 Question 6 Opportunities for collaboration.

From the responses to Question 7 "Outreach and awareness activities" it is clear that knowledge exchange and sharing activities are a common priority, in the form of conferences, public events and webinars. Campaigns were less common, which may be understood considering the requirement of significant resources and planning to run successful campaigns. Also training appears as less relevant to half of the organizations probed.

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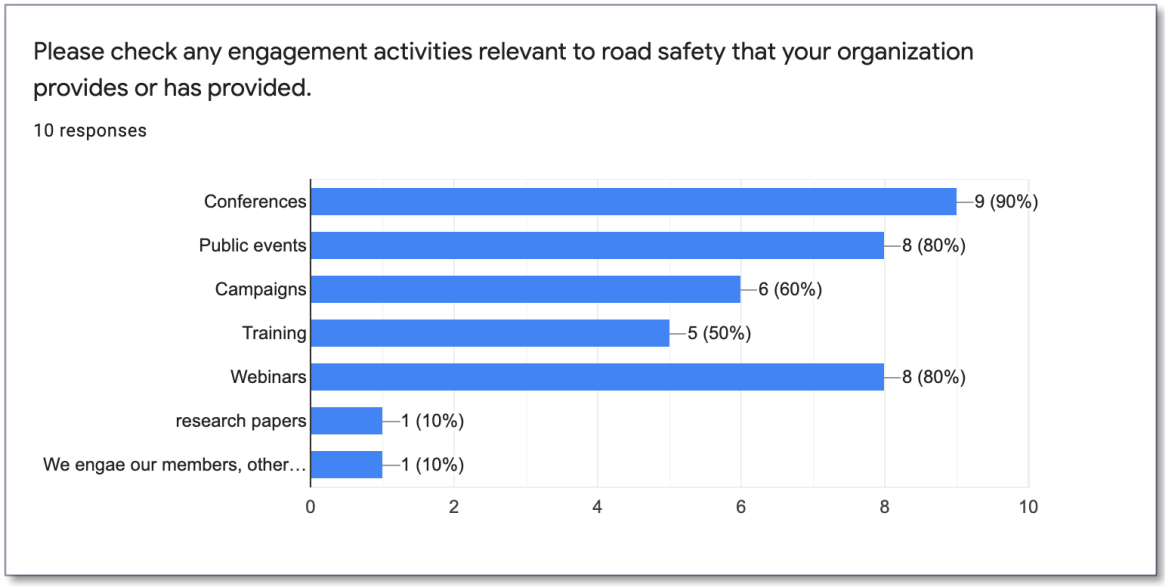

Figure 4.12 Question 7 Outreach and awareness activities.

KT Expertise required

Knowledge translation expertise available to WP6 is itemized in Figure 4.1 Step 4, including personnel from WP6, the consortium and possibilities among external partner networks.

Strategies to address possible expertise gaps

- Build capacity internally – collaboration on KT items, KT workshop for interested consortium partners
- Free online conferences, webinars, resources and tools
- Access to KT & research impact community support
- Literature on KT, implementation science, behaviour change
- Ongoing development of a handbook/compendium of tools and references.

4.1.2 Steps 5-7: Target audiences, main messages, KT goals

Target Knowledge Users

In the language of KT, target audiences are described as knowledge users. To determine KUs (target audiences), we ask,

- Who could benefit from this evidence? (Initial & future SCSs, Demos 2, 3, 4). For example, who is at higher risk for car-to-URU crashes?
- Who can use this evidence to promote URU safety in current and future mixed traffic?
- Who can use this evidence to generate practice change in the road transport and safety ecosystem to reduce road danger for URUs?

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In addition to thinking of the *end* knowledge users where we hope to see the impact of improved safety – such as the road users themselves (drivers and URU) – we can also think about who the *next* KUs are, the intermediaries and purveyors such as driving schools or URU advocacy groups. In this way we try to anticipate all the avenues through which SAFE-UP results can reach the public for a safety benefit to URUs. In WP6 activities, sometimes KU is synonymous with road users (i.e. drivers, motorcycle and moped riders, pedestrians, cyclists, etc.), and sometimes it refers to public authorities and entities operating in the road transport realm such as safety councils, VRU advocacy or interest groups, manufacturers and road safety professionals and researchers. The KTPT© suggests choosing the top 3 KU groups. Figure 4.13 step 5 lists three key KU groups for the current stage of project aims.

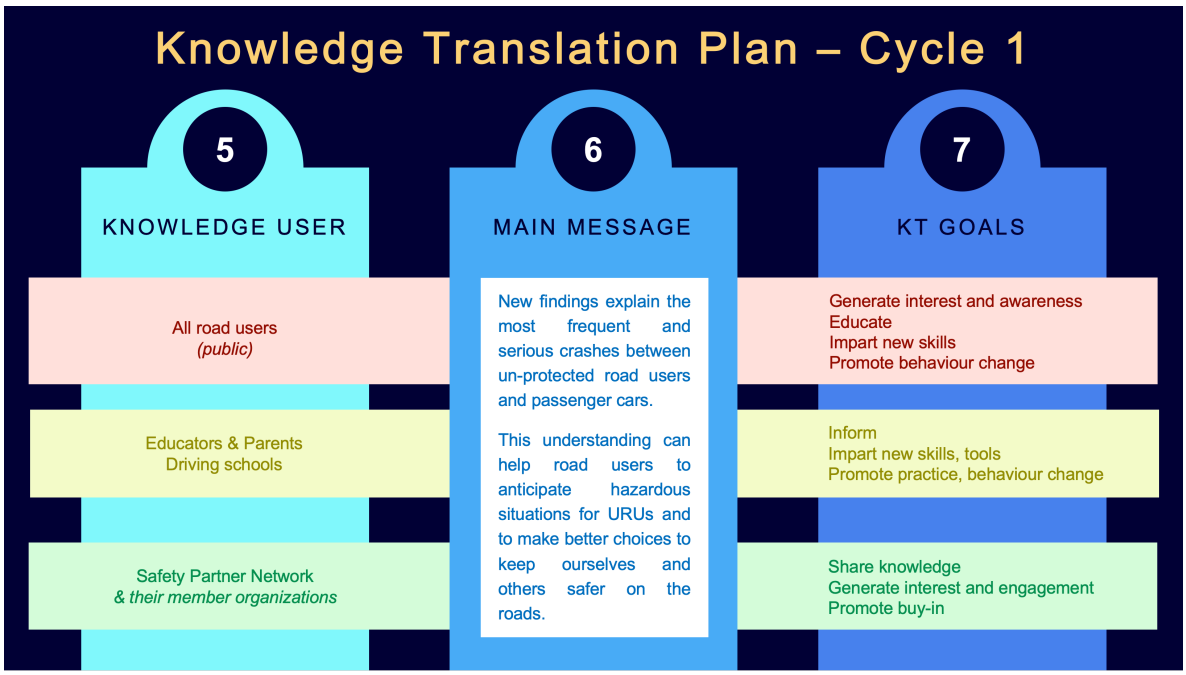

Figure 4.13 Target knowledge users KT goals for one main message from SAFE-UP outcomes.

Main messages

Initial MMs for KT Cycle 1 are provided in D6.1 and will be updated as more project results come available. While tailoring main messages to different target audiences, we should be careful of trying to address too many KU groups, considering the constraints of the SAFE-UP timeline. The KTPT© suggests crafting a tailored MM for each however, for simplicity, the example given in Figure 4.13 step 6 is a general MM applicable to all three KU groups. KT Cycle 1 refers to translation of results from D2.6 on current SCS, as results for future SCS and outcomes from the three SAFE-UP demos are still pending. KT of the current outcomes provides an important foundation for contextualizing results on future SCS in mixed AV traffic. Importantly, this knowledge can be linked to the current safety needs that will be addressed by the innovations being developed, thus highlighting their applicability which may aid acceptance and generate useful exchange of knowledge. Further, the MMs

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describing results on current safety-critical scenarios and use cases for systems being developed in SAFE-UP provide a basis on which to orient discussions with SNPs, *also being timely and relevant to current stakeholder priorities*. Sharing this information with stakeholders is also a strategy for building relationships and partnerships that can later be leveraged to addressing safety in evolving mixed AV traffic when results emerge.

KT Goals

Currently identified goals for 1st KT cycle have already been presented in D6.1 (see Section 4.2.2 below). Figure 4.13 provides some examples of KT goals for one main message, showing how they may differ depending on the KU. KT goals may range from informing various audiences and generating interest, to promoting practice or behaviour change.

4.1.3 Steps 8-10: KT Strategies, evaluation and KT process

KT Strategies

Figure 4.14 illustrates the alignment between with the KT goals proposed KT strategies and KUs. Strategies classified as 'educational' are directed more towards an end user, whereas those designated as 'role-based' are directed at intermediaries such as partners, collaborators and facilitators for dissemination and implementation of research knowledge.

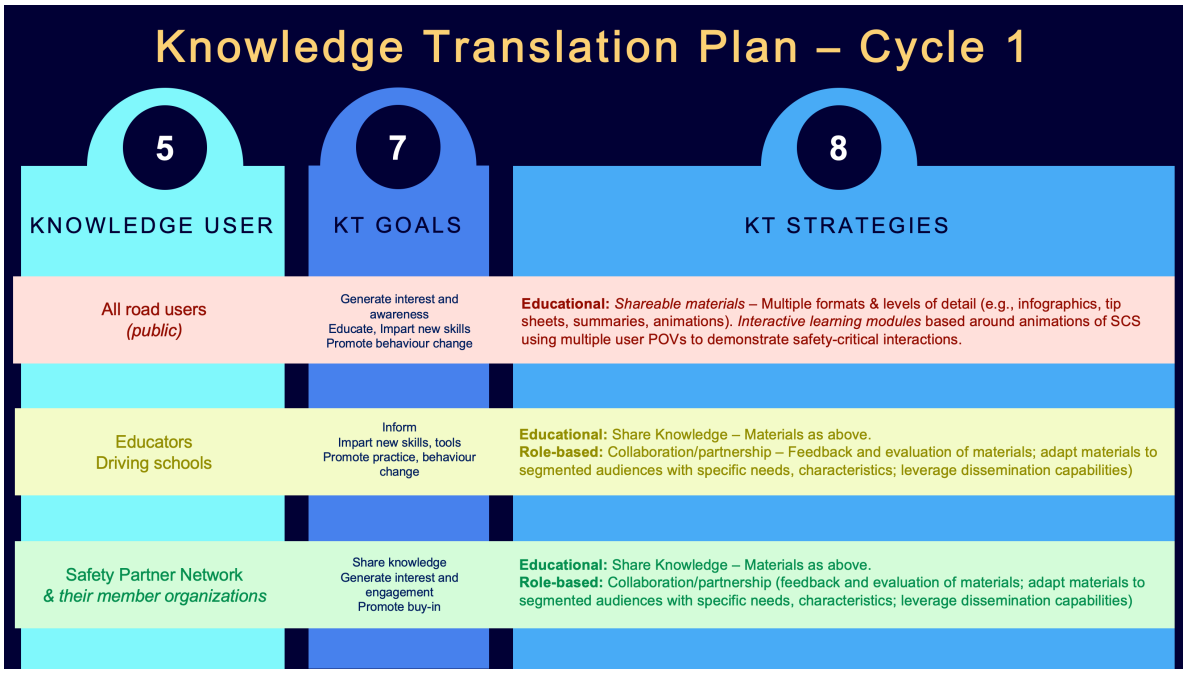

Figure 4.14 KT goals and strategies for one main message (MM).

In keeping with best practice recommendations, we are developing multifaceted/combined KT strategies [6]. This is also a strategy for maximizing productivity by multiplying delivery formats for each main message. For example, informational elements can be provided as

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stand-alone infographics, incorporated into short videos, or learning activities. In fact, these 3 types of knowledge products can be delivered separately, or can be combined into learning and training modules. In addition to providing materials for the Safety Multi-media Library, including such elements as the basis for training modules follows a logical knowledge hierarchy for educational programs, begin with informational level of knowledge, and progress through activities to promote application. Different materials/strategies can be designed to engage different levels of cognitive processes to promote deeper engagement and learning, or different levels of access depending on user needs. These materials will also be delivered to educators so that they can use them or modify the formats to suit their needs and tailor to their audiences.

Delivery and dissemination will also make use of multiple communication channels, such as the SAFE-UP website and those of partners, through organizations' activities, social media. Such an approach promotes accessibility to the same information from multiple access points, according to users' preferences about where they search for information or where they flock. Strategies planned for translating results, e.g. on initial (and future) safety critical scenarios will include some or all of the following:

- Accessible and shareable knowledge packages in multiple formats (e.g. interactive learning modules, infographics, tip sheets, summaries, animations) providing various levels of detail and different aspects of the results.
- Infographics and other materials explaining SCS and factors influencing different crash scenarios.
- Animations of SCS using multiple user POV and contributing factors (infrastructure, behavioural) to demonstrate and explain safety-critical interactions and failures between road users.
- Teaching and learning activities and modules based around these videos

Evaluation

Assessment of individual KT strategies as well as the overall plan requires collection of both qualitative and quantitative measures. Indicators and measures should be factored into the selection of KT strategies, since feasibility of collecting performance measures is critical to achieving accurate assessments. Evaluation will be performed in T6.4 for the educational and training materials produced in T6.2. D6.1 has already provided a detailed list of KPIs which can be modified and applied (and added to or as necessary) to evaluate the additional KT strategies that are being/will be undertaken in the remainder of T6.3. The KPIs reflect assessment indicators and criteria used in knowledge translation and impact evaluation, as well as from education research.

There are many resources and references available on evaluating effectiveness of KT strategies. The KTPT© is a good starting point, drawing from *A Guide to monitoring and evaluating health information products and services* [38]. These references have informed the development of the detailed KPIs (T6.1) to be applied in training development (T6.2) and evaluation (T6.4). An excerpt of the KPIs is provided in the Appendix. More examples of

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indicators for performance aspects of KT strategies such as reach, use, change (knowledge, attitude, systems), etc. are given in Figure 4.15 and Figure 4.16, Step 10. *Best practice in road safety mass media campaigns* [36] provides guidelines for choosing indicators and evaluation methods to assess the effectiveness of strategies on behaviour change outcomes.

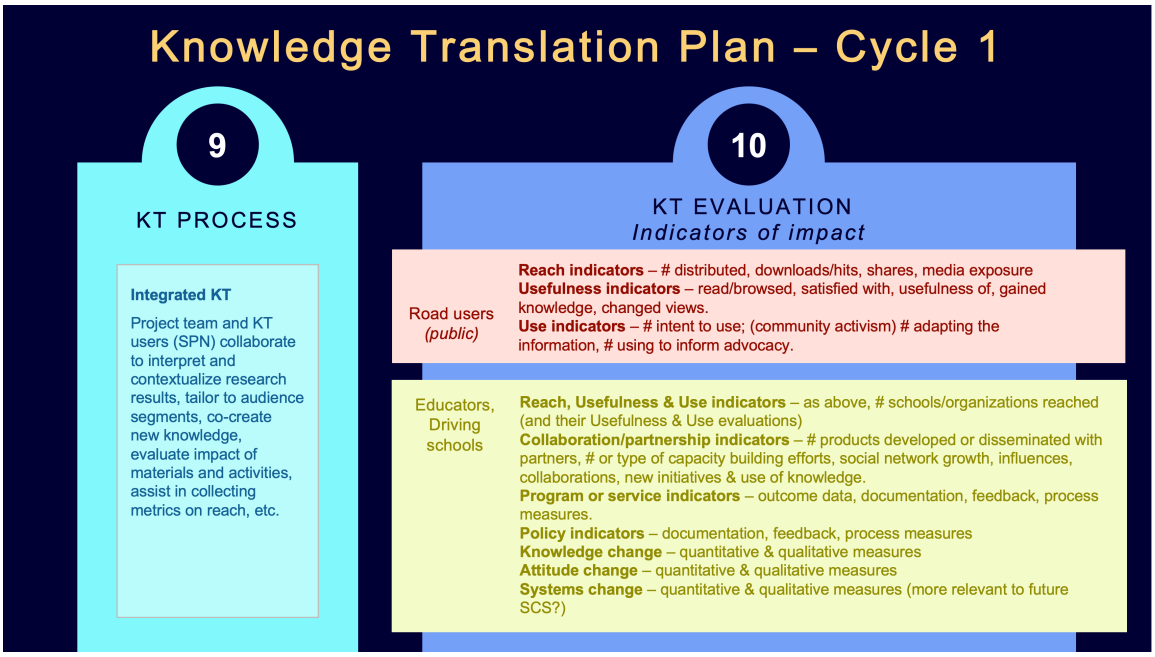

Figure 4.15 KT process and evaluation of KT goals for road users and educators (illustrating one MM).

In addition to evaluating performance of individual KT strategies, an overall evaluation could include items such as the following:

- Items produced
- Tasks achieved
- # mtgs attended
- # plans/collabs created
- Qualitative feedback from SNPs on aims/goals as well as process
- Also, expected impacts and outcomes – end-of-grant and Beyond

Processes for tracking and tracing impact is critical and should be built into the plan. Processes and tools, such as web stats tracking and custom feedback forms will be implemented as materials are disseminated. Alternative metrics, or 'altmetrics' Altmetrics, "are new measures that take into account online reader behavior, network interactions with content, and social media. Altmetrics are meant to complement, not completely replace, traditional impact measures and are measures of online attention and engagement" [40]. Citations and altmetrics are very long-tail and will not be available at the end of the project.

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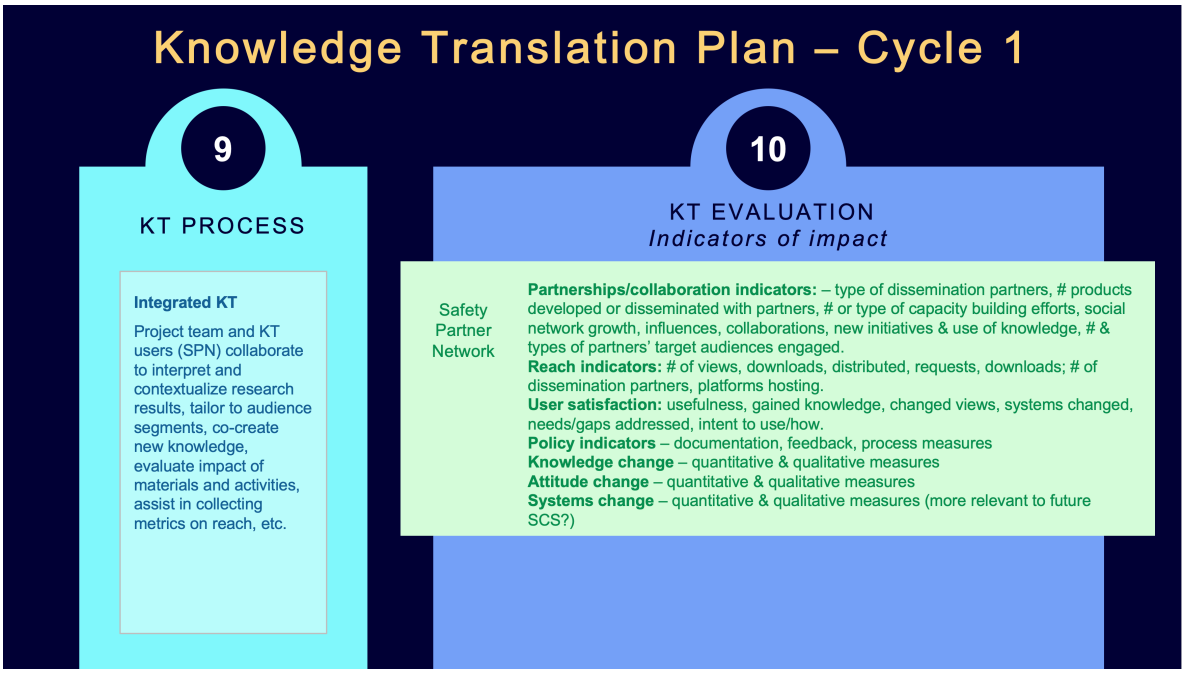

Figure 4.16 KT process and evaluation of KT goals for partners. Sources for indicators: [8, 37].

A best practice [39] example provides guidelines on how to form a narrative for telling the contribution story of the research. The format includes questions for collecting qualitative evaluation data which is an essential aspect of measuring research impact.

> *"Quantitative data will tell you about the problem areas in your impact project while qualitative data will help you understand the cause behind the problem."* [41]

One possible format is provided by Matter of focus [39]:

- What we do/did
- Who we did it with
- How they feel about it
- What they learned and gained
- What they now do differently
- What difference does this make?

Evaluation of the KT strategies developed in WP6 will provide not only estimates or indications of usefulness and potential impact, but also valuable information and lessons learned about the effectiveness of the processes used and how they can be improved. Thus, effective evaluation results in increased capacity of researchers for KT of RSI while contributing to practice evidence in this new field. Evaluations can be used to improve on strategies in updates or future projects, to tell impact stories, and to inform future grant proposals [6, 31]. The KT plan evaluation should be a learning experience for updating and

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improving for future projects. Sarah Norton of Matter of Focus [39] advises researchers to be honest about failure – share one thing that went really badly wrong!

4.1.4 Steps 11-13: Resources needed, budget & implementation

Resources Required

The main resources required for realizing the KT plan are human and expertise. Figure 4.17 Step 11 lists categories of possible required resources. Requirements will differ depending on the KT strategies selected. The advisory board is an important resource for WP6 in providing perspectives from various sectors of road transport and safety. Consortium partners, especially those involved in definitions of safety-critical scenarios and development of demos 2, 3, and 4 assist WP6 in helping to interpret technical developments and results.

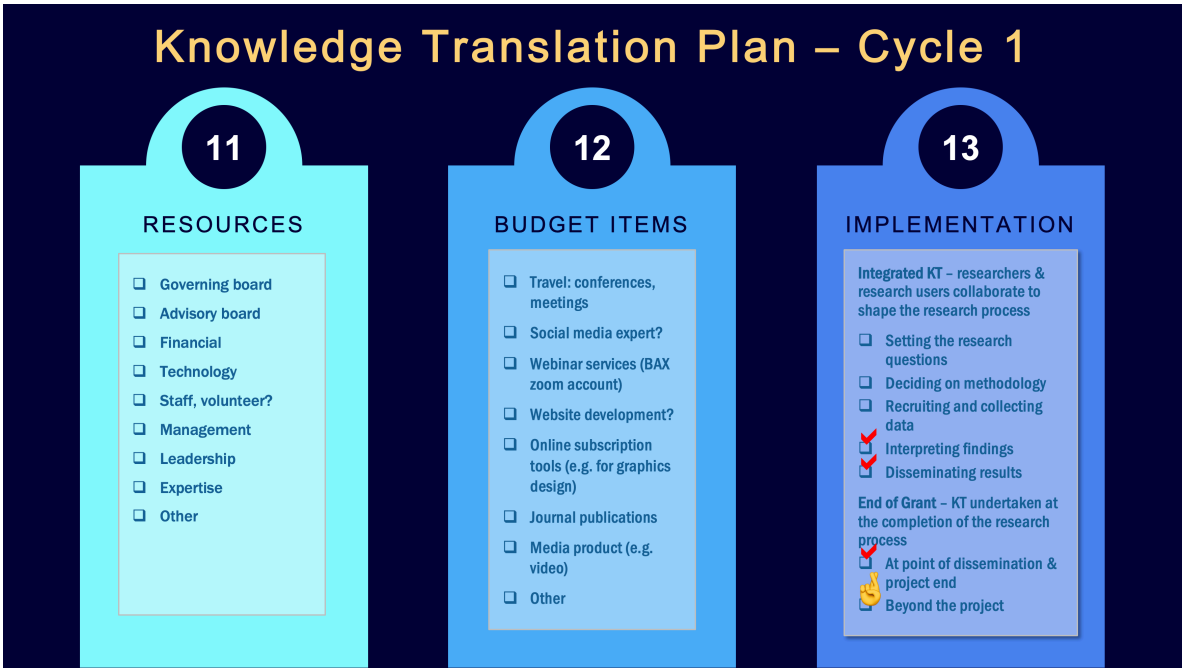

Figure 4.17 Resources required and budget items; implementation strategy

Resource requirements for KT strategies and implementation will factor into feasibility assessments and prioritization decisions for TE&A objectives. Resource requirements may change as the project and KT plan evolve.

Available resources:

- **Advisory** – Advisory board, members of the SPN.
- **Financial** – WP6 budget – salaries, travel (conferences and project meetings), events.
- **Technology** – e.g. animations of crash reconstructions from in-depth crash data.
- **Staff, volunteer** – CERTH graphical and video support, possibly SPN.

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- **Expertise** – As a WP6 participant, THI provides ongoing technical knowledge support for understanding AV & CAV technology and developments in general and WP3 activities in particular. Chalmers, ZF and AUDI, have provided technical knowledge on SCS analyses UNIFI. UNIFI MOVING research group has broad is now becoming more involved to support development of PTW rider TE&A initiatives. Access to specialized expertise in PTW safety, training and licensing is also possible through UNIFI's network.
- **Other**

Budget Items

Typical budget items are listed in Figure 4.17 Step 12. While the KTPT was designed to aid budget creation in grant writing, in SAFE-UP, the KT plan was created after the project budget was defined, being applied as a methodology for realizing WP6 objectives. Thus selection and implementation of KT goals and strategies will have to consider feasibility within the scope of the project. A proposed strategy to maximize WP6 resources is to share knowledge materials to partners and service/information providers who then use them as the bases to create and tailor their own materials adapted to their target audiences and next knowledge users.

Implementation of the KT Plan

The necessary steps to implementing the plan will vary depending on the individual KT goals and selected strategies. Common to all is first to translate of SAFE-UP results into plain language main messages for both general and target audiences. In the example provided in Figure 4.13, a single main message is used for the 3 target audiences depicted. However MMs can be tailored to different KU segments. For example, MMs based on safety-critical scenarios for cyclists could include a generalized one for all audiences, and targeted messages to older and male cyclists and pedestrians, based on higher frequencies of fatalities for these sub-groups (see [3]). To facilitate further development and refinement of target messages, the SPN can be engaged in this stage or after. Implementation will then follow the following steps which (in theory – this is an evolving adaptation/learning!) should represent the completion of KT 1st Cycle:

- Integrate inputs collected in these exchanges into defining (or refining) and prioritizing TE&A goals and in developing and tailoring strategies to achieve them.
- Share with Tier 1 KUs. Collect both formal (through eval tools) and informal feedback on knowledge items *and* the evaluation tools used.
- Integrate feedback in updates to materials and assessment tools.
- Outline a plan for tracking and collecting dissemination and performance metrics and indicators and implement for each item disseminated.
- Disseminate to public with assistance of partners (i.e. through their networks, target audiences and memberships).

This provides an outline of an implementation plan to realize a specific KT goal or related group of goals. For each goal set, more detailed steps will be elaborated.

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4.2 Main outcomes towards WP6 stated objectives

4.2.1 Knowledge gathered from engagement with the Safety Network Partners

"In 1920, the city street was a place where children played, pedestrians walked, and streetcars and horse-drawn vehicles shared the roadway. City streets, like city parks, were for public use. Automobiles were new, moved few people, clogged traffic, and endangered pedestrians. It was unquestioned that automobiles were the source of both the danger and the congestion. Yet by 1930, despite efforts by local police, chambers of commerce, and traffic engineers, the automotive coalition—self-described as 'motordom'—had managed to redefine the city street as a place for motor vehicles only." [42]

– David Hemenway, Department of Health Policy and Management, Harvard Injury Control Research Center

4.2.1.1 SPN Engagement activities

Outreach and engagement activities to M18 have succeeded in developing active contacts with representatives of the different URU groups, as well as those of driving educators, cities and ITS stakeholders. Both one-on-one and group discussions have been fruitful and informative, providing important knowledge on the paradigms, perspectives and topical issues underlying URU advocacy.

A group discussion with representatives from the European Cyclists' Federation (ECF), the Federation of European Motorcyclists' Associations (FEMA), the International Federation of Pedestrians (IFP), and the Institute for Two-Wheeled Safety (IFZ) was held in August 2021 to try to parse out the differences between 'training', 'education' and general 'awareness raising' with regard to how to disseminate new knowledge on road danger and proposed safety interventions in ways that are not only relevant, but appropriate and ethical. Proposed approach to this issue are provided in D6.1 along with guidelines and recommendations for T6.2 in developing TE&A targets, goals and strategies. In brief 'training' for URU safety in relation to AV traffic and systems ranges from *not acceptable* to *identified need* in progression for pedestrians versus cyclists versus PTW riders.

At the end of November, 2021, the WP6 team also hosted an online meeting intended as a KTE workshop to share research results with members Safety Partner Network for discussion, feedback and drafting of relevant main messages. The session was attended by five WP2 researchers (four were presenters), two WP6 researchers, and one BAX representative. Three members of the SPN, representing cyclists, pedestrians and motorcyclists. The AB member representing POLIS, and cities' planning for mobility attended for part of the meeting. SAFE-UP partners shared T2.1 results on initial Safety-

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Critical Scenarios (SCS) in car-to-pedestrian and car-to-bicyclist crashes [see 10]. The intended objective was to discuss the following:

1. Relevance and applicability of the results for external (stakeholder) organizations to identify Main Messages (MMs) that can be translated into TE&A objectives.
2. Collect input on needs and concerns of VRUs in order to better tailor information to targeted audiences and select effective KT strategies.

In order to prepare participants in advance, specific resource materials were shared. A reference on the purpose of stakeholder engagement for research impact [15] as well as the summary notes from the initial meetings with Safety Network Partners (SNPs) were shared with the researchers (and among the SPN reps) for familiarization on URU perspectives and concerns. The SPN members were given a summary of the T2.1 results to review in advance. All participants were given information on the Knowledge Translation planning template, to support the workshop process, which was intended to address steps 5 and 6 of the template to identify target knowledge users and draft main messages.

Feedback and responses from the external partners representing cities and non-motorized URUs focussed largely on problems with the language used to describe car-to-URU crashes, identifying gaps and concerns with regard to the research paradigm and methods of analysis. In general, pedestrian and bicyclist groups share a common vision of overturning the (arguably out-dated) car-centric paradigm and putting people before motorized vehicles in (urban) transport planning and (re)design to insure safe, fair and universal access when using active modes. Consequently, these groups are practiced at identifying gaps in the road transport paradigms that do not account for nor fully understand URU concerns, as well as problems with language usage in results presentation that can perpetuate faulty paradigms about ‘road safety’. It may be fair to say that these groups see as their first engagement task the need to educate on these points and update the narratives used to promote road safety. As a result there was little time for discussion on KT of Task 2.1 results on SCS. From the side of PTW rider representation, the perspective is rather different, since this group often finds itself left out of discussions both from the motor vehicle driver and active mode user points of view.

Learning points:

- Importance of explicitly acknowledging stakeholder concerns in our research presentations, to enhance credibility and generate trust and buy-in.
- There is a potential need to produce guidelines for researchers on communications with URU stakeholders.
- Results should be translated into a simplified, high-level format for sharing with external partners for identifying further KT goals.
- Results should be contextualized in/addressing their concerns up-front, to move more quickly to common goals & collaboration.

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4.2.1.2 Summary of feedback and inputs through SPN engagement

The following summarizes the data gathered from the URU representative organizations, POLIS and the EFA throughout the various engagement activities. For brevity the key issues extracted from meeting notes are provided in bullet points, grouped under thematic headings.

User group terminology is problematic for identity and representation

- (Ped & cyclist POV) Inclusion of PTWs among VRUs is problematic because they have motors and can be dangerous to self & others whereas walking and cycling are benign modes.
- (From PTW side) just because PTWs have motors they are often left out of discussions about unprotected road user safety issues.
- PTWs are also often left out of discussions for road safety solutions infrastructure, vehicle technology, and driver training.
- Being a pedestrian is a universal condition – it is not a separate social demographic group. The term can also be applied skateboarding, inline skating, and of course wheelchair users. In contrast, cyclists may have a stronger political identity. However, cycling is a potential universal option for all.
- PTW riders and car drivers are more easily recognized as distinct user groups – drivers must first train to operate the vehicle and pass exams to receive a license, which is controlled by the state through legislation and enforcement.

PTW riders

- There is a serious lack of knowledge exchange and action regarding PTW rider safety.
- There is too much focus on technical skills, not enough on road safety, hazard perception, etc. We must educate for higher skills.
- It can be difficult to convince public of the usefulness of new safety technology for PTWs. Rider training should include experience using these onboard safety systems (e.g. ABS) to promote rider confidence in the systems so they can receive the proven safety benefits of these systems.
- PTW users need a bigger voice, space in discussions – there is a mismatch between PTW representation and users.
- There are opportunities to improve capacity for KT of PTW safety research.
- The issue of drivers not noticing PTWs or not giving precedence is ongoing and cannot be solved through education and training of riders and drivers alone. Technical solutions are highlighted, including the potential of connected communication between vehicles to provide warnings for drivers to reduce motorcycle crashes.
- Regarding technology innovations for PTWs there is always a concern that these might increase risk by increasing cognitive and/or sensory load.

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- Regarding mixed AV traffic and risks to PTW riders, main topics of concern are sensor insufficiency and operator error or misuse of automated systems on the part of car drivers.
- Concerns about systems in cars which distract drivers and potentially put PTW riders at more risk.
- EuroNCAP is effectively pushing for cars with more distractions (e.g. control screens) and this is a serious concern for PTW rider safety since in the majority of vehicle-to-PTW crashes, the driver does not notice the PTW.
- Known factors in car-to-PTW crashes have not changed in decades – the primary contributing factor is driver error, failure to notice the PTW. Driver perceptions of PTWs is poor. How can we better implement this knowledge? We cannot wait another two decades for implementation of C-ITS to provide warnings between cars and PTWs. Training and awareness is indicated for both car drivers and PTW riders.
- There are many post-license training options for PTW riders in Europe, but only a small percentage of riders take advantage of them. However, people who do post-license training once tend to come back, e.g. each Spring (Germany). Recent German studies show that participation in safety training courses is growing, as is the inclusion of modules on rider assistance systems in training programs.

Historical discourse [sources: 42, 43, 44]

- ‘Jaywalking’ was a term invented by ‘motordom’ to shift focus of blame from motorists [43]. The word "accident" was introduced by the car Lobby. In the 1930´s “the National Automobile Chamber of Commerce, an industry group, established a free wire service for newspapers: Reporters could send in the basic details of a traffic ‘accident’ and would get in return a complete article to print the next day. These articles, printed widely, shifted the blame to pedestrians — signalling that following these new laws was important” [44].
- Also, the term 'jaywalker' meant a nitwit, a country yokel who didn’t understand city ways. It came from a campaign to humiliate pedestrians into behaviour that removed some of the burden of safety from motorists. Using these terms is abusive towards the vulnerable and victims.
- This "us and them" dynamic was inaugurated by the car industry from the early days when the interest and safety of the car occupants were the marketing and technological priority.
- We should all be very sensitive to language and be aware that the dominant discourse often reflects an historic bias which should be analysed and deconstructed. Communities and people have had a bad 20th Century dealing with the car paradigm.

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Gaps created by the car centric paradigm

- Since cars were first introduced, it was always at the cost of constraining URUs - Will the emergence of AVs auger in another century of constraining the movements of pedestrians and cyclists?
- The “Highway mindset" – focusses solution-seeking there, obscures the varied characteristics of different road spaces and their user mix.
- Different road user groups are disadvantaged: e.g. women, children, elderly may have less access to the family car, may be ‘stranded’ in suburbs and forced to walk or cycle long distances with no supportive infrastructure.
- Road safety discourse is typically focused on car occupants because these are the users OEMs are appealing to.
- The “steering wheel perspective” can be misleading in analyzing crashes: drivers say, “pedestrians jump in front of cars”, but in reality, the detection of pedestrians was sudden because the driver’s attention was elsewhere or objects in the environment compromise sightlines. Assessment of causal factors could be artifacts of POV?
- Too much responsibility is put on the individual – this ignores the systemic and structural factors underlying people's behaviour.
- Paradox: while vehicle and infrastructure, designers seek to reduce cognitive load of the driving task, drivers instinctively seek more stimulation – e.g. increasing speed, using cell phone, on-board large screens with mappings and infotainment.
- OEMs, planners appear disconnected from the emergent mobility reality, for examples:
    - The number of people in the EU WITHOUT a driver’s license is going up. Young people can’t afford cars or do not want them. Small PTWs are desirable being more mobile and easier to park in congested areas.
    - Cities are trying to reduce the number of vehicles in urban centres to give back more living space to people, reduce congestion and become more green.

The importance of language

- The words we choose affect how we conceptualize the problem, and can thus constrain the search for solutions.
- Using ‘crash’ instead of ‘accidents’ is preferable as it acknowledges that crashes are predictable and crash reduction can be approached through (re)design.
- Unprotected road user is preferable to vulnerable – ‘vulnerable’ falsely suggests a defining trait of a group, but this shifts focus from motorized vehicles being the sources of danger to the unprotected users.
- Terms preferred over ‘VRU’ or ‘URU’ are ‘active modes’ and even ‘preferred modes’, in relation to sustainable urban mobility, more liveable cities, lower congestion and improved health and well-being for citizens (all connected to UNESCO’s SDGs).

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Driver training, behaviour & AV systems

- There are gaps in driver training on ADAS, and systems are constantly changing.
- Concerns exist across stakeholder groups about how drivers interact with current driving-assisted and future automated systems: deliberate misuse (e.g. to fool warnings to replace hands, testing the limits), misinterpretations of system capabilities, over trust.
- Incomplete understanding of system capabilities also stems from misleading communication from car manufacturers.
- The problem of partial automation – takeover response, misunderstanding, misuse – is recognized across stakeholder groups.
- Driver training must be updated to include evolving AV functions, but as yet there is no standard recommendation or approach to implementing these changes.
- Manuals on automated systems provided by vehicle manufacturers are not an effective method of driver education for safe vehicle operation.
- The best drivers are the ones who already have experience using other mobility modes. How drivers perceive interactions, and the behaviors they expect from other users are based on what they know. If drivers don't accept other behaviors easily it is likely because they don't understand the needs of other mobility users.
- There are important regional differences in awareness of responsibility or risks.

Myths around URUs & causal factors of crashes

- It is important to identify false or misleading discourse about safe pedestrian behaviour. What are often considered "common sense" [safety rules] may not (always) be true or be applicable.
    - We are told to make sure before crossing the road that the driver sees us, but this is often impossible.
    - From a 25 m stopping distance, how can you see through the windshield which likely has reflections?
    - Cell phone distraction by pedestrians isn't causing more accidents, its distraction of drivers (https://parachute.ca/en/program/vision-zero/).

What is (are) the favoured paradigm or strategies?

- The 'hierarchy of controls' approach to eliminate or minimize exposure to hazards should be applied to make roads safer (Road Safety at Work) [45].
- Reduce speed limits in urban centres in URU dense areas.
- REMOVE danger, rather than trying to make the danger safer or expecting people to adapt to it:
    - Remove/reduce the number of private cars.
    - Improve public transport.

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- Teach experts what is going on in cities and what the priorities are.
- Promote modal shifts: this also addresses public transport efficiency and air pollution. Statistics highlight the feasibility of modal shift, with 50% of car journeys being under 5 km distance and 80% under 8 km [46, 47, 48].

- Advocates refer to the 8 80 rule proposed by the Toronto organization 8 80 Cities (https://www.880cities.org/) which states that any interventions should be good for an 8 year-old and an 80 year old – then it will be good for all. The safety of the most vulnerable should be the yardstick to measure the quality of an ethically acceptable automated transport system and should be the centrepiece of the debate.

4.2.2 Inputs to T6.1

The following outcomes have already been reported in D6.1 as Inputs to Task 6.1, for application in Task 6.2:

- Informed definition of TE&A themes (see Table 4.2) and objectives based on:
  - Project objectives and activities
  - Inputs from SPN
  - EU urban mobility and safety themes
- Identification of initial Main Messages from D2.6 results (initial SCS).

The safety theme**s** outlined in Table 4.2 represent the knowledge content areas from which to develop the main messages and TE&A objectives. Themes 1 and 2 are the first priorities for meeting WP6 objectives. For the themes of future SCSs and active safety (demos 2, 3, 4) specific KT goals have not yet been defined as the evidence base is still pending. Themes 3 and 4, *Driver training on L2-L4 systems use* and *Engaging URU stakeholders in planning & implementation of road safety innovations* are considered “wish list” items. These are seen as are very relevant objectives, with the potential to address important gaps in translation and implementation of RSI which could be addressed in future projects.

Initial main messages were drafted based on D2.6 results on initial safety-critical scenarios as well as from interpretation of user needs collected from the SPN and perceived gaps in implementation of RSI. The MMs provide the basis for determining specific learning objectives to be addressed in Training, Education & Awareness content and strategies. An excerpt of initial main messages reported in D6.1 is provide below in Table 4.3. Note that the table layout follows the KTPT© steps from 5 to 8.

The TE&A objectives will be further refined and updated in ongoing T6.3 activities to support development of KT products (remember that training and educational activities are considered KT strategies.) Recall that education, awareness, and new skills are examples of *KT goals*, while training, infographics and webinars are examples of *KT strategies*. This conceptual overlap is not problematic since WP6 tasks are very interrelated.

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Table 4.2 Identified Safety Themes for KT goals and training programs. Source: D6.1.

Priority order	Safety Theme / Issue	Target Audience(s)
1	Safety-Critical Scenarios (current and future)	• All road users
2	Demos 2 & 3: Enhanced sensors & active safety for URU detection and avoidance Demo 4: CITS & app for URU smart devices	• All road users
3	Driver training on automation systems for Levels 2 to 4 (see [49])	• Current drivers • Future drivers • Association of driving schools • Driving schools • Driving instructors
4	Engaging URU stakeholders in planning & implementation of road safety innovations	• OEMs • public authorities • decision makers • researchers

Implementing the training and education development framework in T6.2, KT goals for education and training are elaborated as desired Learning Outcomes (see [3] for details). Using Bloom's taxonomy of educational objectives, each learning outcome is coded as to type of knowledge is required and what level of cognitive processes should be engaged. From this, we can determine which TE&A objectives require or would be optimally realized by engaging the user in dedicated learning activities (T6.2), versus those which can be conveyed in simpler formats for a wider reach (T6.3). Since best practice shows that multiple formats are most effective anyway, each overall KT goal/TE&A objective will be addressed using multiple formats and disseminated through multiple channels.

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Table 4.3 Logic flow from main messages to KT strategies. Source: D6.1, excerpt from Table 4.5.

Main message	Evidence	KUs	KT Goals	KT Strategies
In anticipation of disruptions to traffic patterns in evolving AV traffic, SAFE-UP is developing safety innovations to protect people outside and inside cars, together with educational and awareness strategies to keep people up-to-date on safety technology developments and how to keep Unprotected Road Users safe.	Project motivations, aims and activities.	Partners (SPN, AB) General public	Generate awareness, buy-in and acceptance. Make the research available to a broad audience.	• Short explanatory video(s) • Other materials for broad audiences focussing on different content elements from video
New findings explain the most frequent and serious crashes between un-protected road users and passenger cars. This understanding can help road users to anticipate hazardous situations for URUs and to make better choices to keep ourselves and others safer on the roads.	• T2.1 results in D2.6: Initial Safety-Critical Scenarios • Feedback from SPN on relevance, messaging and URU concerns. • Other research	Partners (SPN, AB) Educators & driving instructors Road users (URUs & drivers)	Generate awareness Inform Educate Impart skills, tools Promote behaviour change	• Tailored materials according to KU preferences, needs. • Infographics. • Videos based on crash reconstructions showing multiple user POV. • Interactive learning modules integrating the above materials.

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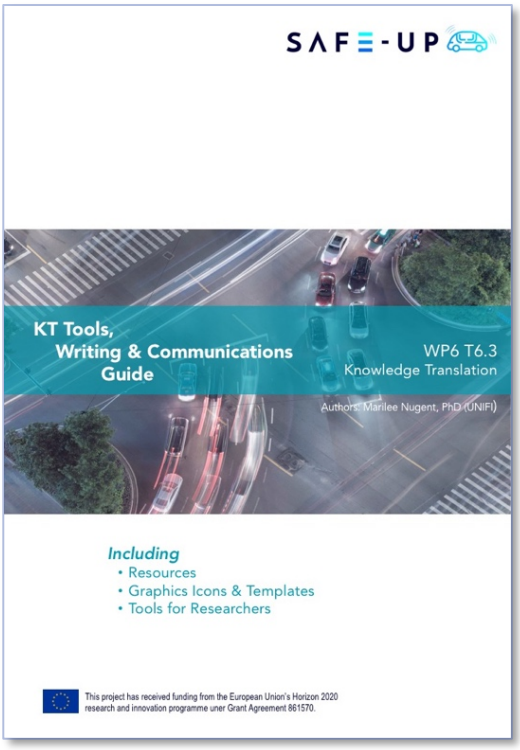
4.2.3 SAFE-UP KT Handbook for researchers: Tools, Writing & Communications Guide

This handbook is a work in progress, being a compendium of tools, references, and resources available to researchers to aid dissemination and communication of research to audiences beyond the traditional academic channels. The materials include KT resources and references, guidelines for plain language writing, awareness of the sensitive issues and history about unprotected road users, and best practice in journalistic writing for news coverage of road crashes.



Item: Compendium of tools, links and guidelines

- KT planning, tools references
- Plain language writing
- Communicating crash research
- Understanding URU advocates POV and concerns
- Free online tools & apps for generating KT products

Purpose: Aid for researchers in translating research for non-academic audiences.

(In progress)

Figure 4.18 SAFE-UP KT tools, writing & research communications guide.

4.2.4 KT Items produced and in progress

Figure 4.19 SAFE-UP Project description.

Item: Plain language description of project.

Purpose: Inform, generate interest.

In collaboration with BAX

View original

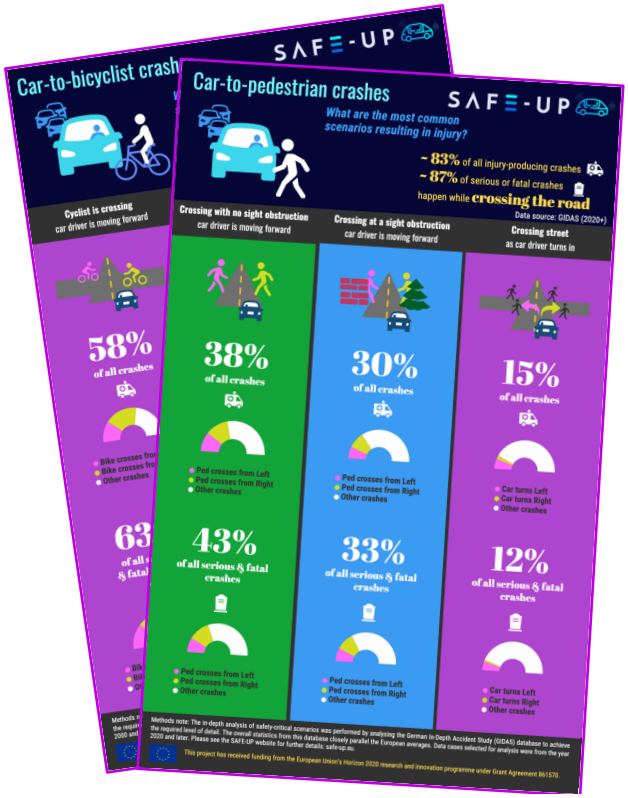


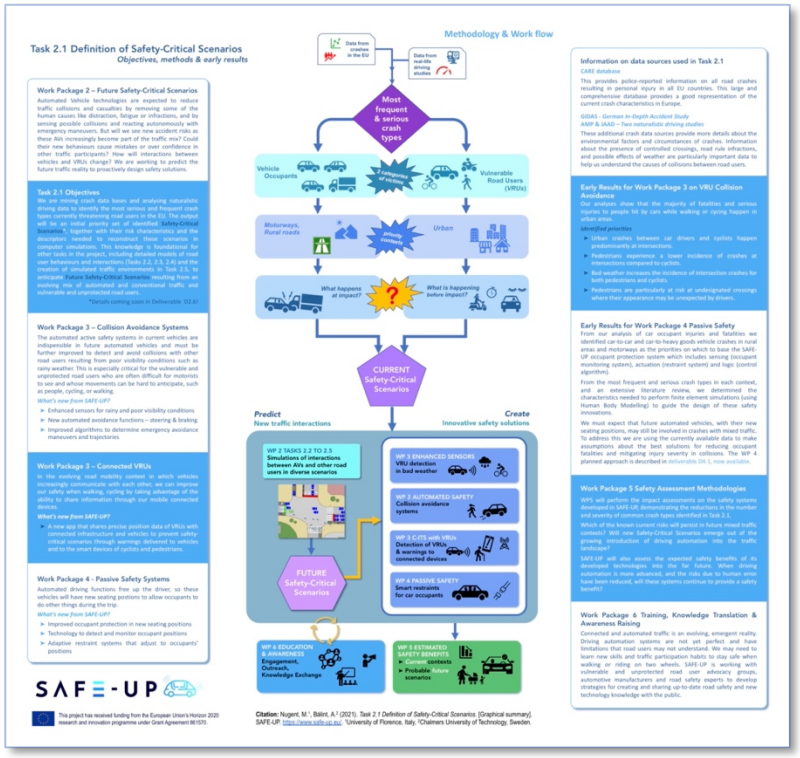
Figure 4.20 Most common scenarios in car-to-pedestrian and car-to-bicyclist crashes.

Item: Info graphics.

Purpose: Inform, educate.

In collaboration with WP2 researchers.

(Uploads pending)



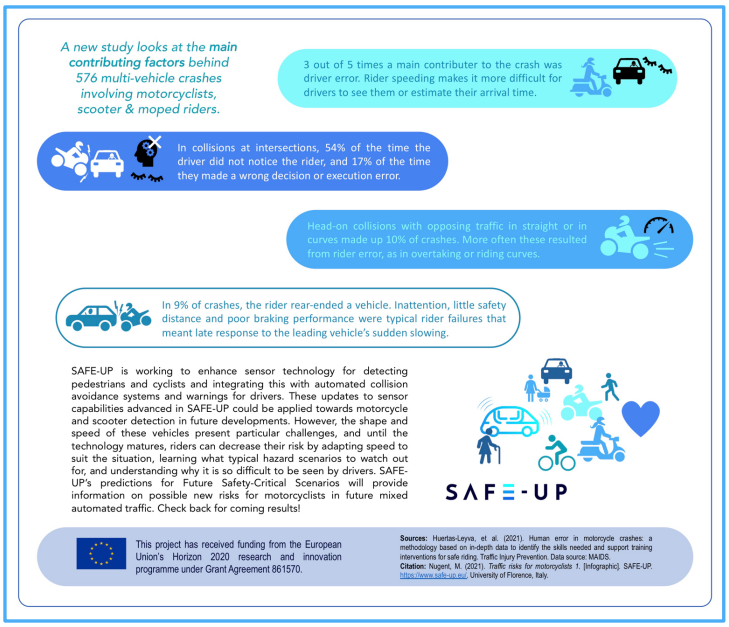
Item: Infographic.

Purpose: Inform, generate interest.

In collaboration with WP2 researchers.

View original

Figure 4.21 T2.1 Early results summary.



Item: Infographic. Separate points reformatted in smaller graphics for social media.

Purpose: Inform, educate, motivate behaviour change.

In collaboration with WP2 researchers, BAX (social media versions).

View full version

Figure 4.22 Contributing factors in car-involved PTW crashes.

Item: Plain language summary of research.

Purpose: Inform, (also learning for T6.3 researcher), provide early content for website (before project results) using relevant most recent research, provide context for SAFE-UP aims.

View full article

Jan 28

Communication between automated vehicles and vulnerable road users in future traffic

In the new opinion paper 'Vulnerable road users and the coming wave of automated vehicles: Expert perspectives' 16 experts in human factors and vehicle automation technology weigh in on the hot issues and challenges of integrating vehicle automation and connected technologies in urban traffic. How will AVs and vulnerable road-users - pedestrians, cyclists, motorcyclists - interact? What messages need to be communicated between them and how?

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Can automated vehicles (AVs) make urban traffic environments safer for vulnerable road users (VRUs)? By reducing human error - *and bad decisions* - the hope is that the majority of causal factors in vehicle-to-VRU crashes can be drastically reduced. A vehicle programmed to obey road rules would not run amber or red lights, suddenly try to make a turn from the wrong lane, exceed speed limits in pedestrian dense areas, fail to stop at an occupied zebra crossing, or drive under the influence of alcohol.

Sounds promising on paper, but what are the practical challenges? Most of the automation research has been done on highway environments where, although traffic flows at high speeds, road user interactions are more predictable than in urban environments. In cities and towns, however, the modes of travel are more varied and the interactions are much more complex. Through both instinct and cultural training, we exploit the exchange of many different forms of signals and social cues to predict what others driving, walking, cycling, running intend to do next, to help us make decisions about our own movements. So too, AVs will have not only to detect VRUs but predict their behaviour and communicate the vehicle's intentions.

In this new opinion paper, 16 researchers in human factors were interviewed for their expert personal opinions on the current status of technological developments, bringing us up to date on the ongoing challenges to be addressed for safe interaction between VRUs and AVs in the future urban traffic.

How automated will future traffic be? The evolution of mixed automated traffic

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5. Discussion

"A little knowledge that acts is worth infinitely more than much knowledge that is idle."

- Kahlil Gibran (1883–1931) Poet, philosopher, and artist

The system of practices and processes known as Knowledge Translation is being applied as the methodology for executing WP6 aims for training, education and awareness raising for URU safety in future mixed automated traffic. Currently, there are scant examples of KT – also known as pathways to impact – being used to help 'bring road safety research to life'. However, there is high potential for the system to enhance and possibly accelerate the benefits of improved safety for road users through the timely, relevant and tailored application of evidence towards change in policy, practice and behaviour. In applying KT to road safety innovation, goals for changes in practice and behaviour can be thought of at both institutional levels and at the level of the person in the street.

There exists a wealth of literature, case studies, training opportunities, tools, frameworks, and best practice examples for how to connect research outcomes with the people who need them, for faster more effective positive impact. Important fields of research and practice that can be leveraged for KT for RSI include KT, implementation science, impact planning and evaluation, and behaviour change.

Two aspects that are critical to successful KT are stakeholder engagement and planning for the impact we want to achieve. By initiating the Safety Partner Network, we aim to bring in points of view that represent the characteristics of the different road user modes – walking, cycling, motorcycling. Through exchange and synthesis of knowledge we can come to understand the needs of specific user groups, and how to tailor safety information to be relevant and necessary, in forms that are useable, delivered in a timely manner to promote desired changes in knowledge, behaviour or practice.

A general takeaway message from SPN engagement is the importance and challenge of communicating road safety research results in ways that are already contextualized in URU advocates concerns. Indeed, for researchers to be considered credible and up-to-date with current URU mobility issues, we must show an appropriate level of literacy about the lived contexts in which RSI will be implemented. There are leading organizations in injury prevention already producing best practice examples of KT for road safety. Readers are strongly encouraged to review the Vision Zero program of Parachute Canada as an excellent example of effective KT and as a comprehensive learning resource for general to professional audiences.

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Importantly, two conflicts between user needs and project objectives have been identified early on. 1) The lack of acceptance for a wearable C-ITS device for VRUs amongst pedestrian and cyclist advocacy groups parallels concerns expressed by the advisory board to the steering committee that OEMs will not accept information external to the vehicles determining automated responses. 2) Training for cyclists and pedestrians to adapt to dangerous conditions is not acceptable since focus should be on removing the danger.

These contributions from SPN members – perspectives about road danger from the vulnerable mode points of view and identification of gaps within the research paradigm to properly take these into account, is important for stimulating dialogue to enable development of TE&A strategies that communicate honestly and clearly about system use cases and limitations while clearly identifying and explaining specific advantages in mitigating road danger. As well, in order for proposed strategies to be acceptable, effective and sustainable, they must contextualized within the current accepted paradigms that aim to leverage the safe systems approach and promote active mode use for more liveable, sustainable cities.

In the second half of the project, it will be important to expand engagement activities as we begin to disseminate knowledge products and collect feedback and input from a larger sample of stakeholders.

We have proposed that the requirement to adopt a flexible updateable approach to creating TE&A strategies that can keep pace with the emerging and regionally varied traffic contexts may be met through application of the Knowledge Translation Planning Template©. This framework guides researchers in creating a plan for sharing new knowledge from research which begins with the initiation of a project, not waiting until the end. By integrating stakeholder engagement early on, their consultations help to identify target audiences and to translate the results into messages and formats that are relevant to knowledge users' needs, contexts and characteristics. The iterative nature of a KT plan systematizes a continuous updating approach to targeted dissemination efforts. Once an initial plan is created, outputs can be updated and improved through (i) availability of new road safety data and partner inputs (ii) feedback and evaluation collected on knowledge products and strategies produced, (iii) increased capacity and experience of the researchers/KT practitioners, (iv) creation of new goals and initiatives based on updated identified user needs and new research questions.

The primary objectives of a KT plan are to share knowledge, inform, educate and raise awareness. Goals for practice change and behaviour change would require separate implementation plans, informed by implementation science and behaviour change theory, which is likely beyond the scope or means of this project. Given the relatively short life of the project, the 'experimental' stage of KT for RSI, combined with the gap in knowledge between current traffic contexts and the imagined future, it is safe to say that it is not yet time to roll out an educational scheme or behaviour change campaign on how to interact with AVs. What we can do is inform, raise awareness and generate interest and literacy on the current and anticipated safety issues that SAFE-UP is working to address, along with the expected benefits and functional limitations of these interventions. We can also begin developing processes to be in place for leveraging the rapid synthesis of new data to inform

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decision making and update audiences on new developments and imminent changes in the traffic context. Importantly, such processes should include ongoing engagement with different knowledge users and road users to improve effectiveness of the safety innovations and their implementation. Casting an eye towards implementation of future TE&A strategies a model for implementation success in human services [37] illustrates important considerations. The Active Implementation Formula [50] shown in Figure 5.1 shows three key components. According to the formula, “If any component is weak then intended outcomes will not be achieved, sustained or used on a socially significant scale.” [6]

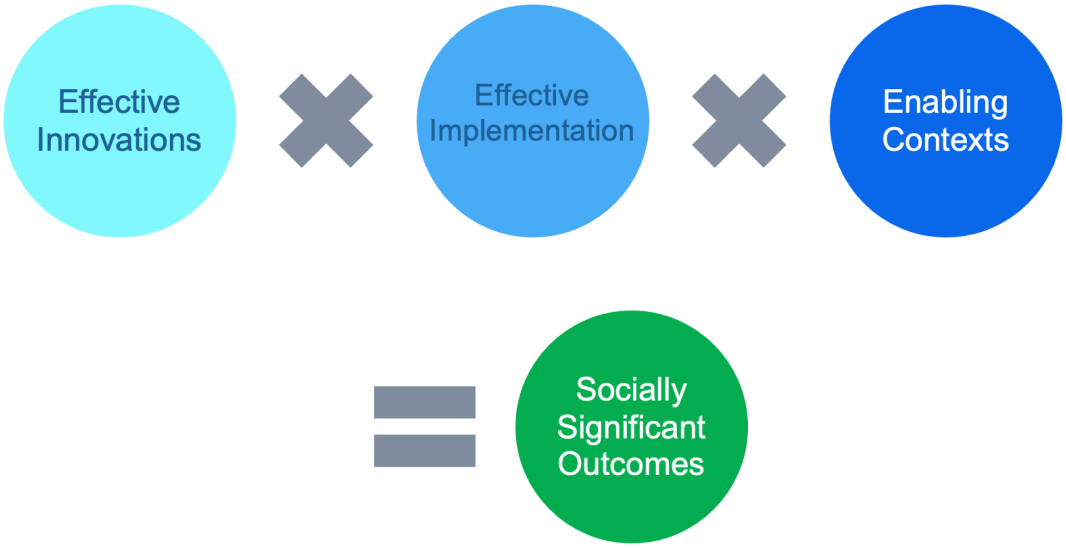

Figure 5.1 Formula for implementation success.

The formula makes clear that even if a proposed innovation should be highly effective in improving road user safety, if an appropriate implementation plan is lacking or fails to consider the state of readiness of the context, we would likely not see the expected benefits. This would make accurate measurement of the effectiveness of the intervention problematic. Further, this model may highlight suspected gaps in current approaches for rider and driver safety training and evaluation of training programs. Programs may not be effectively implemented, for example if instructors are not provided with necessary training. Or there may be a mismatch between the program content and the reality of the driving contexts. Nevertheless, interventions can be implemented while they are still being developed! This way they can be updated as new data are received. Uptake into practice will then be faster and better adapted to the real-world context(s) [6].

This deliverable has described the processes developed and being applied to creating training, education and awareness strategies to promote URU safety in future mixed AV traffic. Initial materials for dissemination have been produced as the first outcomes for the

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online Safety Media Library. We envision that this 'experiment in KT for road safety innovation' will also represent a project outcome. It is hoped that some of the processes and partner relationships developed during the life of SAFE-UP will continue to be relevant beyond end of grant. This deliverable is offered not only as a report on the work, but as an introduction to knowledge translation principles and practices to aid researchers, developers and stakeholders in RSI.

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7. Appendix

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7.1 KPIs for TE&A programs

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The full table of identified KPIs can be found in D6.1 [3] Section 4.5.

Table 7.1 Detailed KPIs & indicators for TE&A programs & initiatives. Source: D6.1 excerpt from Table 4.7.

	Performance Criteria by category of Knowledge User (KU)		Performance Measures	
Performance characteristics	**WRT target KU(s) as road users**	**WRT target KU(s) as next KUs**	**Proposed Targets end-of-grant†**	**Proposed Targets by 2030**

Content
Main Messages
Learning objectives
KT Goals
	• Evidence-based – from:
	  ○ SAFE-UP outcomes
	  ○ Stakeholder inputs
	  ○ Literature & crash statistics analyses
	  ○ Future mobility roadmaps
	  ○ road safety roadmaps
	  ○ Roadmaps for CAV & CITS R&I?
	• LOs are clearly defined and coded by *knowledge type* & *cognitive process*
	• Updateable to integrate new evidence
	• Timely, i.e. applicable now or near future
		• Internal, external experts and URU advocacy groups consulted & involved.
		• Evidence-based – from:
		  ○ SAFE-UP outcomes
		  ○ Stakeholder inputs
		  ○ Literature & crash statistics analyses
		  ○ Future mobility roadmaps
		  ○ road safety roadmaps
		  ○ Roadmaps for CAV & CITS R&I
		• Updateable to integrate new evidence
		• Timely, i.e. applicable now or near future
			• Inclusion of relevant, high quality references
			• Number & type of organizations consulted, their relevance and positioning as influencers, representatives of users
			• Approval, acceptance of 85% of MMs defined
			• Collaborations – with who, what was the nature, importance
			• Each Learning Outcome is evidence-based
				• Evidence of continued development and refinement based on SAFE-UP contribution

TE&A Strategies	• *(Refer also to content criteria)*
	• Evidence-based
	  ○ Road safety education initiatives
	  ○ Learning models
	  ○ Behaviour change models
	• Feasible (KT plan → TE&A objectives updated regularly)
	• Alignment between LOs, TLA, Assessment methods
	• Addresses all relevant knowledge levels and elicits cognitive processes, according to stated LOs
	• TLA are engaging & stimulate active learning
		• *(Refer also to content criteria)*
		• Evidence-based (external partners consulted)
		  ○ Demonstrated interest in SAFE-UP outcomes
		  ○ Demonstrated interest in WP6 aims
		• Agreement with KUs on knowledge required, formats, and timing of exchange
		• KT plan (updated regularly)
			• Within limited WP6 budget or with receipt of in-kind assistance internally, or externally
			• Within project timeline
			• Coordinates realistically with timing from outputs from other WPs
			• Achievable with limited WP6 human resources (time, budget & expertise/capacity)
			• Alignment is confirmed through tools and collaborative peer assessment (researchers & interested partners)
				• Has provided overall a sound basis for current approaches
				• Approaches have been further tested, refined, developed
				• 10 citations for each key document in academic and other literature (e.g. driver training programs, traffic safety and mobility educational programs)