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Way forward for Public Procurement of Innovation in C-ITS deployment

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Abstract

Public procurement of innovation (PPI) has a great potential to boost the deployment of Cooperative Intelligent Transport Systems and Services (C-ITS) on our roads. By acting as early adopters, public procurers can drive the development of innovative ITS solutions from various vendors towards concrete mobility needs for people and goods. However, lack of strategy, knowledge and experience hamper this potential. This paper presents the recommendations on the way forward for PPI inC-ITS by the P4ITS consortium. These are described in detail in deliverable D6.2, available on www.p4its.eu. P4ITS is co-funded by the European Union under Competitiveness and Innovation Programme (CIP).

Keywords:

Public procurement of innovation, cooperative ITS, P4ITS.

The definition of Public Procurement of Innovation (PPI)

PPI is an abbreviation for 'Public Procurement of Innovation'. The term 'innovation' is used in many different contexts and with various interpretations. In the PPI context, 'innovation' must be understood as '*implementation of a new or significantly improved product, service or process*', in accordance with the definition set forth in the new procurement directive (Directive 2014/24/EU, Article 2 (1), n. 22). Therefore, 'innovation' basically means rethinking and it shall be clearly distinguished from 'research and development' (R&D). To this end, a short definition elaborated by the European Commission is given in Figure 1. The figure illustrates the difference between procurement of R&D, often referred to as Pre-Commercial Procurement (PCP), and procurement of 'innovation', commonly referred to as Public Procurement of Innovation (PPI), where the basic definitions are:

- ***PCP*** *is intended to steer the development of solutions towards concrete public sector needs, whilst comparing / validating alternative solution approaches from various vendors*
- ***PPI*** *is intended to act as launching customer / early adopter / first buyer of innovative commercial end-solutions newly arriving on the market.*

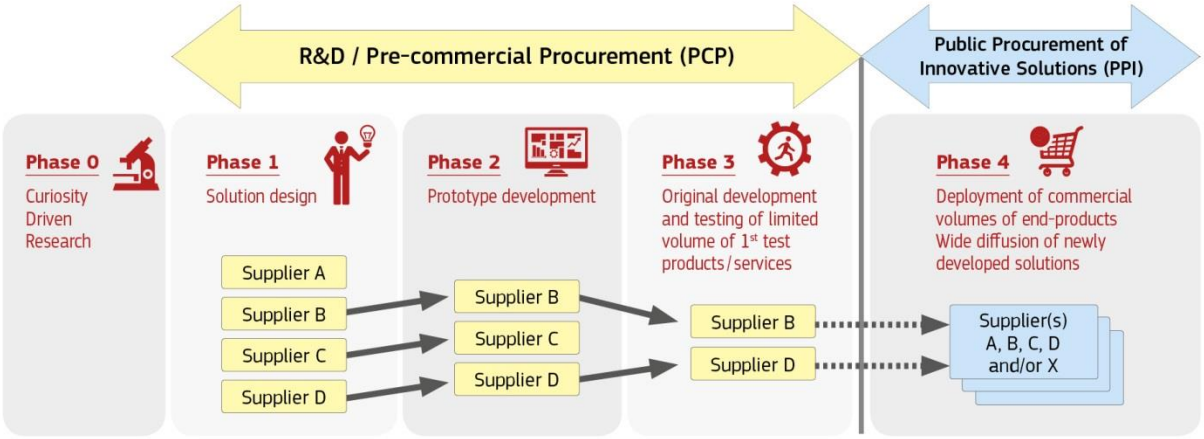

Figure 1 - Innovation procurement chart [1]

The rationale behind Figure 1 has been to raise awareness on procurement of R&D and of innovation, for which the EU has established new funding mechanisms under the Horizon 2020 programme. In line with it, PPI must be understood as 'the innovation strategies and operational approaches needed to enhance procurement of innovation, including enhancing market penetration speed for innovative solutions'. While PCP is about developing new solutions through R&D, often resulting in prototypes, the keywords for PPI in Figure 1 are '*commercial volumes*' and '*newly developed end-products*', which refer to the maturity/readiness of both the solution and the market. Innovation is also utilisation of existing solutions for new purposes or in new environments. PPI may therefore also encompass the procurement of solutions based on existing technologies that are to be utilised in a new and innovative way. Not least in the context of C-ITS, the P4ITS network considers that PPI may therefore also include R&D, e.g. for the adaption and integration of innovative solutions.

As it will appear below, the definition of PPI must be extended to encompass the whole procurement action of innovative solutions. This also includes PPI strategies, initial market investigations and consultations, provided that the procurement action has as its main goal to provide the foundation for a final and sufficiently specific procurement of e.g. a system or a service. Hence, contrary to the concept of PCP, PPI is not introducing a certain procedure or method of procurement.

P4ITS flowchart to understand PPI in relation to C-ITS

Based on the above, P4ITS developed the flowchart shown in Figure 2 to illustrate the concept of PPI from the point of view of the public procurer. The flowchart is intended as a ***conceptual reference*** to common issues and themes related to PPI among public procurers of innovative solutions for (cooperative) ITS and their counterparts from other entities and countries, with a view to developing a more concerted approach in Europe. This PPI flowchart aims to identify the types of procurements that can be followed (procurement of R&D, procurement of innovation, or conventional procurement) in relation to the development level of the new / innovative solution, in terms of Technology Readiness Level (TRL). The flowchart does not encompass any recommendations for specific procurement procedures (open or restricted procedure, competitive dialogue etc.).

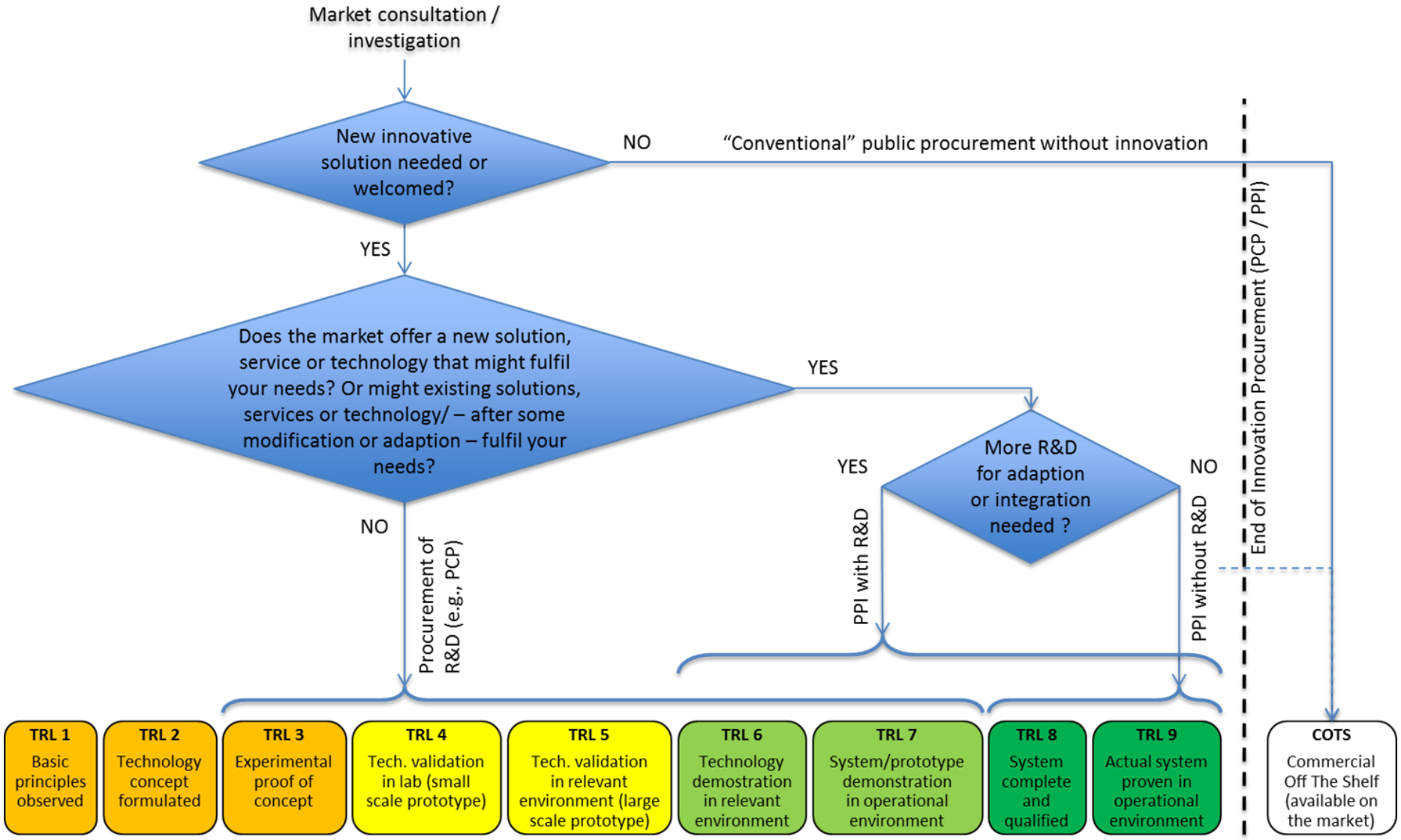

Figure 2 - Flowchart defining the PPI concept in relation to the TRL[2]

As mentioned previously, PPI must not be understood as a term for a certain procurement procedure. PPI is procedure-neutral and in principle any procedure within the procurement directives is applicable in a PPI action, although some Member States in national legislation or guidelines may require procuring authorities to follow specific procurement procedures or procedural steps when procuring new, innovative solutions. Therefore, and conversely to PCP, PPI actions can be understood as supporting initiatives enhancing procurement of innovation. PPI can be understood as either:

A. European, national, regional or local ***programmes/strategies/policies*** supporting procurement of innovation, such as strategies on making daily procurement more innovation friendly (e.g., target to carry out with a PPI approach 20% of all procurement actions) or multi authority cooperation with a certain economic mass, allowing market penetration of new (yet undiscovered) innovative solutions in grand joint procurement projects; or
B. The technical or legal ***approaches*** one can adopt to enhance the possibilities of new innovative solutions to win a tender (in this document also referred to as 'PPI approaches'). Hence, on an operational level the PPI approaches are the very fundamental preconditions for PPI actions and the principles behind PPI approaches can be used in any public procurement procedure, including day-to-day 'conventional' procurement, to enhance the possibilities for obtaining new solutions for the needs of the procuring authority.

PPI might therefore be part of a mix of policies aiming to encourage the procurement of both R&D and innovation in the performance of public tasks or to address societal challenges and needs. As such, a policy mix can therefore comprise both PCP and PPI strategies.

C-ITS development and deployment to date

In the frame of C-ITS development and deployment, typically the procurer has a good understanding of the needs, of the functional requirements and, sometimes, also of the technical specifications of the end-solution that has to be acquired. However, commercial off-the-shelf (COTS) solutions are often missing and, therefore, even if the technology framework can be defined, there are no products or services available on the market that can match it. A PPI strategy and/or approach can be an efficient way to acquire the necessary solutions by cooperation and dialogue between the supply and the demand side, e.g. through a well-scheduled and well-planned market consultation. By doing so, there would be a reciprocal visibility on longer-term policy, implementation plans and operational needs of the procuring organisation as well as on the technology evolution on the industry side, unveiling new market opportunities for both.

Research on C-ITS systems has already been carried out over the past decades through national and European R&D programmes and projects led by the industry, research establishments and academia, thus reaching a significant level of maturity of the so-called ***Day 1 services*** [3] to provide e.g., warnings about location of road hazards and in-vehicle signage applications. Some COTS technology solutions are now available for these services. Cooperative systems and services are thus a reality and mature enough to enter the market: technology concepts proved to work, test prototypes have been

deployed and piloted in operational environments (i.e. in real-life traffic conditions) reaching a TRL 7. On the other hand, the so-called ***Day 1.5 services*** [3] have reached a maturity around TRL 5-6 and have higher chances to be further developed and fully deployed by means of PPI actions. Day 1.5 solutions are built on knowledge and solutions created already in previous R&D projects in different ITS areas (not only C-ITS).

The different steps that have led to the above mentioned Day 1-1.5 services are presented in Table 1 in relation to the TRL achieved. Table 1 links the information already presented in Figure 2 to past and ongoing reference projects in field of (cooperative) ITS and traffic management.

Building on findings of previous basic research (TRL 1-2), after 2006 the first proof of concept resulted from C-ITS projects such as COOPERS [4], CVIS [5] and SAFESPOT [6], in which the technology for roadside and in-vehicle communication was developed and demonstrated. Feasibility issues and areas for technology improvement were identified for further field operational testing. Based on some pre-tests undertaken in Pre-DRIVE [7], two field operational test (FOT) were completed in 2014 (DRIVE C2X [8]) and 2015 (FOTSIS [9]). The results of these small scale FOTs together have been the basis for real-life urban pilots such as Compass4D [10] and CO-GISTICS [11] as well as for national and regional pilot corridors like SCOOP@F [12], Eco-AT [13], NordicWay [14], and the international C-ITS Corridor [15]).

However, cooperative systems and services (including Day 1 services) have been tested and deployed only in small scale field trials and pilots on the basis of pre-commercial solutions (i.e., up to TRL 7), and large scale deployments are needed. Regional/national implementations of such pre-commercial solutions and cross-site operations aimed to define common standards and achieve interoperability, whilst evaluating cost-benefit analysis and user acceptance of various end-solutions, and setting up new business models.

Even if the C-ITS technology is proven in operational, real-life environments, the benefits need to be further demonstrated for decision makers and end-users. Furthermore, to ensure harmonised and seamless C-ITS end-user services, systems still need to become truly interoperable. This does not necessarily mean that all deployments need to rely on the same communication technologies or components, but it needs to be ensured that travellers will receive their services at the expected quality across Europe, even when the underlying technology is different (e.g., services will be transmitted through short range communication means like ITS-G5 as well as through cellular communication networks). Public acceptance of C-ITS, e.g. in relation to data protection and privacy issues, have to be solved as well to achieve sufficient levels of penetration of innovative C-ITS solutions, and to allow delivery of expected benefits and roll out a sustainable market.

Large-scale pilot tests across Europe are currently being set up for instance under the 2015 CEF Transport call for proposals [16]. These tests will show where additional R&D is required to meet the new needs of public authorities, e.g. in the area of secure service transmission. New functionalities and hybrid solutions shall be integrated into existing legacy systems for advanced traffic management, rather than creating new isolated solutions, thus keeping products and services in line with the functional requirements and technical specifications defined. Road operators shall move from physical

towards a digital traffic management infrastructure (as per e.g. ECo-AT vision in Figure 3) and from general towards personalised and targeted traffic management (e.g., not one message for all vehicles, but different personalised messages for different vehicles, such as taxis, trucks, buses, or service vehicles). This would create new possibilities for active traffic management and facilitate working towards common goals, thus moving from a reactive traffic management concept towards proactive solutions/alternatives (network benefit optimisation).

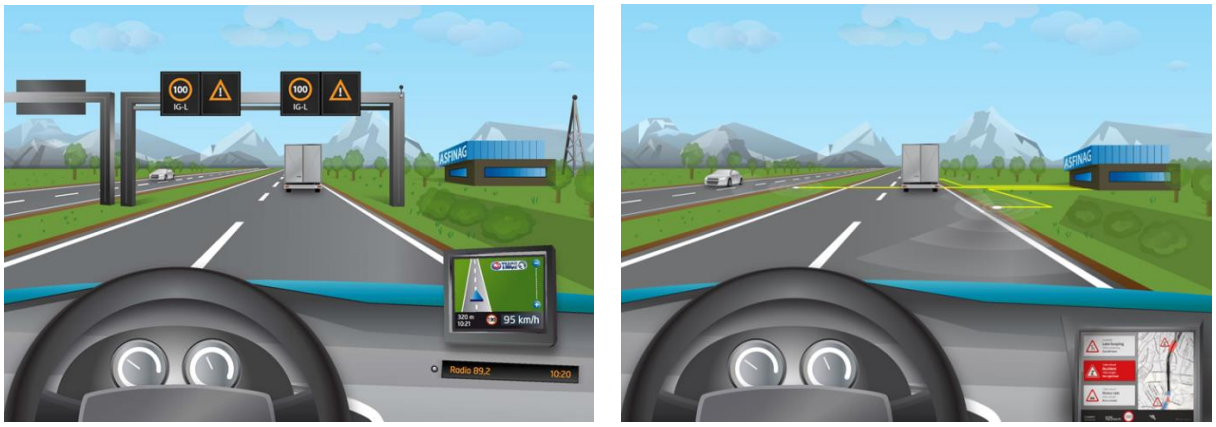

Figure 3 - Driver's perspective today (left) and tomorrow (right) according to ECo-AT vision

The PCP project CHARM [17] was launched in 2012 to challenge the market to develop innovative modules that fit within a new, flexible, common architecture for traffic management centres (TMCs). Divided in 3 phases (solution design, prototyping and pre-production), it covers TRLs from 3 to 5.

Table 1: Acquisition actions in relation to C-ITS development / deployment phases

TRL	**R&D and pilot deployment activities in the field of C-ITS**	**PCP actions**	**PPI actions Speeding procurement and deployment**	
			Public procurers: To increase number of stakeholders	**Industry:** To achieve critical mass of the market
1-2	Basic research	/	/	/
3	Research program (CVIS, SAFESPOT, COOPERS, CHARM-PCP Phase 1)	Proof of concept. Description for evaluation (solution design)	/	/
4	Demonstration inside research program (small prototyping Pre-DRIVE, CHARM-PCP Phase 2)	Prototype for evaluation (pre-production prototype)	/	/
5	Validation in research program (Pre-DRIVE, CHARM-PCP Phase 3)	Prototype available (pre-commercial testing)	/	/

TRL	R&D and pilot deployment activities in	PCP actions	PPI actions Speeding procurement and deployment	
6	Field operational tests (DRIVE C2X, FOTSIS)	Small-scale testing (controlled tests on public roads)	Evaluation and validation for deployment in pilots	Small-scale testing (prototype), including complementary R&D
7	CIP program or CEF (Compass4D, CO-GISTICS, NordicWay, ECo-AT, SCOOP@F)	End of PCP (beginning of PPI)	Deployment and validation in pilots	Evaluation for deployment (final prototype)
8	TEN-T or CEF, Interreg, Structural Funds	/	Large-scale deployment	Large-scale deployment
9	TEN-T or CEF, Structural Funds	/	Large-scale deployment	Introduction of product / service into the market
	Regional and local deployment funds	/	End of PPI	COTS items (products or services) on the market

Potential for the use of PPI in C-ITS

PPI strategies and actions shall not be considered as a complex set-up, difficult to implement, but rather as - as already mentioned, strategies and procurement approaches enabling decision makers and public procurers to communicate on a large-scale the needs / problems of public transport authorities, and to make the requirements acknowledged by the market players. This way, PPI actions are also an opportunity for new cooperation between procurers and suppliers to find solutions together while gathering knowledge important for both sides. Based on such knowledge, strategic decisions and implementation plans can be defined to achieve a reliable evaluation of the cost-benefit ratio of innovative solutions compared to existing ones. This can support decision making and increase purchasing power at a later stage, thus creating higher interest on the procurer side. At the same time, the information provided by the public procurers through a market consultation has high potential to stimulate the competition (in a healthy way), to provide better visibility to public procurers and suppliers, and hence stimulate market growth, while reducing the risk of potential vendor or technology lock-in. In addition, PPI actions can open up to ICT based multi-sector solutions, which are easier to find than solutions related just to the transport sector, and the ITS sector in particular.

Depending on the complexity of the need or problem, the procurement of innovative C-ITS solutions may require a multidisciplinary team including ITS specialists, procurement specialists, lawyers, and strong project management. However, this should not require heavy bureaucratic procedures regulating PPI, but rather a new cultural approach to procurement of innovation. In this way, different experts sit together and cooperate first to achieve common understanding and mutual learning with open minds, then to implement procurement actions of C-ITS solution based e.g. on life cycle costing or total cost of ownership.

In the most complex cases, when multiannual strategic plans have to be implemented at national level, this requires the involvement of car manufacturers, IT providers, content and service providers, drivers, administrations, standardisation organisations to consider European ITS action plans & delegated acts where the road authority is no longer at the centre of the network. In practise, it may be difficult to prioritise all the stakeholders, and it must be acknowledged that every party has its own agenda and different financial situation and level of expectation. Therefore, a PPI strategy should encompass a long term communication plan of future needs followed by well-scheduled marked consultations. However, when it is about solutions for urban, peri- / inter-urban transport, the level of complexity is significantly lower since there are less influencing factors and the public procurer can investigate a large market based on a simple formulation of the need, or the definition of the functional requirement or, when known, of the technical specifications.

For a successful large scale deployment and market rollout of innovative C-ITS solutions, it is therefore very important to include reflections about procurement as from the very early phases of development and implementation, i.e. already when formulating the problem or needs to be communicated to the market. Planning a PPI approach well ahead, and communicating the PPI approach to the market, is a way to give to both procurer and the suppliers a clear vision of the project and to make it easier to define the main tasks and milestones. Figure 4 shows an example of how this could be done. Providing such level of clarity will automatically trigger a positive impact on the management of the resources, schedule and results of the final deployment.

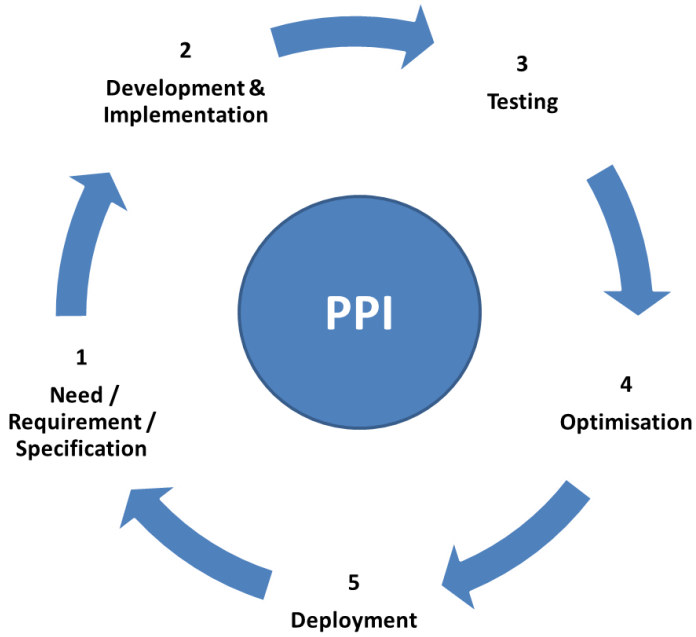

Figure 4 - C-ITS development / deployment built around a PPI approach

In the specific field of C-ITS, thanks to the level of maturity of technologies, short-term targeted PPI actions may therefore be a better support action than long-term R&D activities as regards the challenges related to the last steps of deployment, when objectives, roles and responsibilities of

different actors on specific tasks can be defined more in detail as compared to exploratory research and highly risky developments. To encourage public authorities and to engage industry players in utilising the possibilities of innovation procurement provided for in the EU procurement directives and other instruments provided by the Commission, the Commission has, since the end of 2015, launched few calls for tenders [18] addressing key issues identified during the first phase of the EU C-ITS Platform, namely: 1) A pilot project to identify and demonstrate the benefits from the application of C-ITS services in urban environments and support interoperable pilot deployment of solutions; 2) a study on access to in-vehicle data and resources.

PPI to procure harmonised C-ITS services

The procurement of harmonised services is now needed on the operational level to create a truly European single market to ensure interoperability and continuity of services based on end-user acceptance. PPI actions could be used in Europe to speed up the market by working actively together to find solutions and to ensure minimum market size. As mentioned, PPI actions may therefore represent a good opportunity for public authorities to steer the cooperation between private companies and research organisations and speed up this large scale deployment process and for market uptake. It would also offer the opportunity to bring C-ITS into the arena of innovative thinkers from other ICT sectors with their experiences and, possibly, potential market players with radically new approaches and disruptive business models and sustainable market solutions.

Conclusions on the use of PPI to bring innovation in C-ITS

Public procurement in Europe has a yearly purchasing level of about 3,5% of Europe's GDP (Strand et al. 2011, p.4) [19]. If one compares this number to the 2,01% of the GDP (Eurostat, 2015) [20] expenditure on R&D in the EU28 in 2013 the relevance of using public procurement strategically can be seen. As part of a policy mix, PPI can be one approach to tackle some major challenge that the society is facing, often called the "Grand Challenges". The European Union has defined six Societal Challenges, which are also the focus of the funding within the Horizon 2020 framework programme. ITS can especially play a part in solving the challenge of '*smart, green and integrated transport*'.

Given its huge economic significance, public procurement has the potential to influence the market in terms of production and consumption trends in favour of environmentally friendly, socially responsible and innovative products and services on a large scale. The willingness to integrate policy objectives into public procurement is already widespread throughout Europe, and the European Union also attributes considerable importance to this issue as an important measure for implementing the "EU 2020" strategy, as well as the European sustainability strategy. (Kahlenborn et. al 2011) [21].

Based on different case studies, the EAFIP identified following benefits that PPI can generate (EAFIP 2016, p. 14-21) [22]:

- ***PPI is improving the quality and/ or efficiency of services:*** when procuring an established service or product the entry costs are mostly cheaper, but the cost benefits analyses of the whole life cycle of the solution often proved positive. One reason for this could be that the early

announcement "of the expected long-term quality/efficiency improvements may thus prove crucial in PPI… give suppliers enough time … to bring products to the market at the required quality" (EAFIP 2016, p. 14)

- ***PPI is supporting innovative (start-up) companies:*** by providing an immediate sales opportunity that innovative companies would probably not have got through commercial procurement PPI is supporting these companies. In the future they may sell their solutions internationally and fuel the growth of Europe's economy and competitiveness.
- ***PPI incentivizes companies to invest in innovation:*** unlike PCP, PPI is not financing R&D, but by sending a signal to the suppliers that there is a demand for a significant volume of a new innovative solution they are trigged to make these investments themselves, because they see a potential new market.

If the rationale behind these points above is compared to the process of traditional procurement – buying something off the shelf, usually for the lowest price – there is a huge difference. Public Procurement of Innovation is much more than a simple buying and tendering process; it requires strategic and cross-sectorial, long-term thinking. Whereas traditional procurement is '*based on short-term tactical purchasing considerations, usually prioritising low cost over quality or looking only at immediate instead of long term cost quality impact*' (EAFIP 2016, p. 18). Public procurers are naturally very risk-adverse, avoiding new solutions as potential deployment risks. Using no new solutions can potentially lead to a vendor lock-in (EAFIP 2016). Without a clear goal based on a national strategy and the commitment of the policy makers, they will not start procuring innovations by themselves. Governments have to reflect their role and think about how they can use the purchasing power strategically. Doing so, they are able to foster innovation, the creation of new markets, growth and the creation of jobs.

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