



# 5G-PPP Projects Impact on SDO Technical Report

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## ***Abstract***

*In June 2020 the 5G-IA Pre-Standardisation Working Group launched a survey aiming at analysing the impact on standardisation achieved by 5G-PPP projects. The ultimate goal of the survey was identifying weaknesses and strengths, preventing or facilitating research results transfer to standardisation bodies. This technical report includes the highlights from the survey, contributed by projects on voluntarily basis, and summarises the main conclusions which might be a valuable input to devise actions to improve the impact on standards of the next EU Research Framework Programme.*

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## Revision History

Date	Version	Description	Contributor	Revision
22.06.20	V0.1	Table of Content	R. Trivisonno	S. Parker
27.08.20	V0.2	Sections: 1 Scope and Objectives 2. Contributing Projects 3 5G-PPP Projects Impact on SDO 4. Success Factors 5. Improvement Points (First draft)	R. Trivisonno, S. Parker.	S. Parker, R. Trivisonno.
22.09.20	V0.3	Revision and update of sections 1, 2, 3, 4 and 5.	D. Boswarthick, Wint Yi Poe, D. Artunedo, A. Mourad, D. Patel, R. Fantini.	R. Trivisonno, S. Parker, A. Kaloxylas, N. Guney.
30.09.20	V0.4	Sections: Abstract Executive Summary 6. Conclusions	R. Trivisonno.	S. Parker.
10.10.20	V1.0	Revision of all sections.	--	A. Kousaridas, T. Walter, D. Boswarthick, S. Parker, R. Trivisonno.



## Executive Summary

A survey has been conducted **to assess the impact on standardisation of 5G-PPP projects** from Horizon 2020 research framework programme. The survey aimed at documenting the most notable achieved impacts of research projects on the relevant 5G standards and at identifying areas of improvement to maximise technology transfer “from research to standards” for future research frameworks (e.g. Horizon Europe).

**Fourteen projects responded** to the survey, on voluntarily basis.

The survey highlighted a **strong interest in standardisation by 5G-PPP projects**, evidence being the high number of respondents to the survey, the multiple bodies each projects declared interest in (4 SDOs per project, on average) and the long list of bodies of interest (12 SDOs, including NGMN, 5GAA, 5G-ACIA, O-RAN, ONAP, W3C, CEPT, ETSI, 3GPP, IEEE, IETF/IRTF and ITU).

**ETSI and 3GPP appeared to be by far the privilege targets**, as around 80% of the respondents declared achieved and/or planned impact on both ETSI and 3GPP.

The survey highlighted remarkable results from several projects, both in terms of amount of submitted standard contributions and overall influence on 5G standardisation activity agenda.

A review of the reasons behind the success of the best performing projects, led to identifying the following common **success factors**:

- participation to the project of researchers with strong experience in standardization;
- relevance of the project objectives to standardisation bodies scope;
- good understanding of existing standardization roadmaps.

The survey allowed to formulate **recommendations** to improve the performance of future projects with standardisation impact ambitions:

- research objectives and project time plan to be aligned to the expected standardisation timeline of the target SDO research results shall be transferred to;
- project consortium with significant presence of organisations and researchers with solid standardisation expertise;
- project timely engagement in the relevant SDO activities, with timing and format coherent with the project standardisation objectives.

Finally, to facilitate the application of the above recommendations, an activity has been triggered by the 5G-IA Pre-Standardisation WG, aiming at defining a **B5G/6G Research and Standardisation roadmap**, defining the areas of research to investigate, the type of research results to generate and their ideal timing, to facilitate a successful delivery to the relevant standardisation bodies.





## 1. Scope and Objectives

This technical report summarises the outcome of a survey on the achieved and planned impact of 5G-PPP Horizon 2020 projects on Standards Development Organisations (SDOs).

The objectives of the survey are:

- Documenting the most notable achieved and planned impact of 5G-PPP Horizon 2020 research projects on the relevant 5G standards.
- Identifying areas of improvement to maximise technology transfer from research to standards for future research frameworks (e.g. Horizon Europe).

Projects provided input to the survey on voluntarily basis. Despite the good response to the call for input, only a limited albeit significant number of projects took part to the survey (approximately 30% of 5G-PPP projects from Phase 2 and Phase 3 contributed to the survey). For this reason, the results of the survey do not necessarily precisely represent the achieved and planned SDO impact of the whole 5G-PPP framework. The available data is anyway sufficient to draw some general conclusions.

## 2. Contributing Projects

The survey was launched within 5G-IA Pre-Standardisation WG in April 2020, calling for input from all projects active in the WG. The survey was closed in July 2020. The 5G-PPP Horizon 2020 projects which contributed to the survey are listed in

Table 1.

Project Name	5G-PPP Phase
<b>5G Carmen</b>	Phase 3 (Part 2)
<b>5G Clarity</b>	Phase 3 (Part 4)
<b>5G Croco</b>	Phase 3 (Part 2)
<b>5G Dive</b>	Phase 3 (Part 3)
<b>5G Drones</b>	Phase 3 (Part 3)
<b>5G Eve</b>	Phase 3 (Part 1)
<b>5G Genesis</b>	Phase 3 (Part 1)
<b>5Growth</b>	Phase 3 (Part 3)
<b>5G Mobix</b>	Phase 3 (Part 2)
<b>5G Tours</b>	Phase 3 (Part 3)
<b>5G Smart</b>	Phase 3 (Part 3)
<b>5G Victori</b>	Phase 3 (Part 3)
<b>5G Vinni</b>	Phase 3 (Part 1)
<b>SAT 5G</b>	Phase 2



*Table 1: List of 5G-PPP Projects Contributing to the Survey*

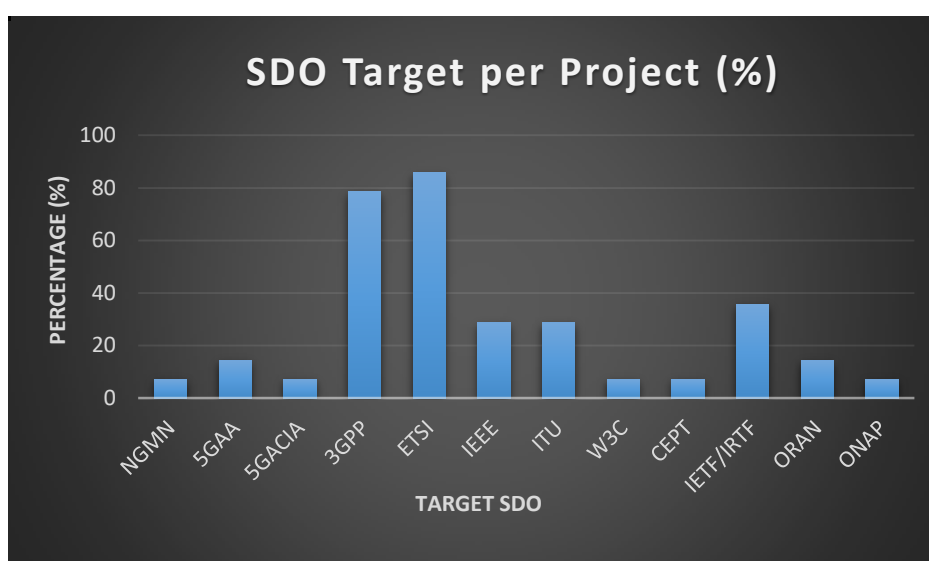
### 3. 5G-PPP Projects Achieved and Planned Impact on SDO

The significant response to the survey confirms the high attention research projects devoted to deliver research results to 5G standards, transferring use cases, requirements and technologies to the relevant bodies.

The heterogeneity of research projects and the relating objectives are reflected in a wide variety of targeted pre-standardisation and standardisation bodies, including industrial alliances, associations, foundations and consortia (e.g. NGMN, 5GAA, 5G-ACIA, O-RAN, ONAP, W3C, CEPT), as well as ETSI, 3GPP, IEEE, IETF/IRTF and ITU working groups.

Two different types of impact were highlighted by the survey: requirements definition and technologies/solutions transfer. Requirements definition affected predominantly pre-standardisation bodies (e.g. NGMN, 5GAA, 5GACIA), ITU and 3GPP SA1 TSG, while technologies/solutions were mainly transferred to 3GPP RAN and SA TSGs, IETF/IRTF, IEEE, ETSI ISGs.

Probably due to the heterogeneity of activities within each project, most projects were and are actually targeting impact on multiple bodies. However, it is relevant to note ETSI and 3GPP are by far the primary targets, as around 80% of the respondents to the survey declared achieved and/or planned impact on both ETSI and 3GPP. **Figure 1** illustrates the percentage of projects achieving and/or planning impact on each SDO reported as relevant by at least one project. Reasons for ETSI and 3GPP to be privileged target might be both technical and strategic: the areas of work of ETSI and 3GPP may be close to the scope of the projects, and may have higher relevance to the actual development of 5G products and services.



*Figure 1: Percentage of Projects Targeting each SDO*



A closer look to the target ETSI TCs/ISGs and 3GPP TSGs provides further insight on the technical aspects. On ETSI side, 3 ISGs were targeted by more than 25% of the projects: Network Functions Virtualisation (NFV) ISG, Experiential Networked Intelligence (ENI) ISG and Zero touch network & Service Management (ZSM) ISG. This reflects the high interest projects manifested towards network management, automation and intelligence areas. Other target TC/ISGs were OSM, MEC (15%+), TC ITS, IPV6, and TC RRS (5% - 10%). These results are illustrated in **Figure 2**. On 3GPP side, SA2 TSG (Architecture) appears to be the preferred target, with 50% of the projects delivering results to it. Very significant is also the impact towards RAN2 (Radio layer 2 and Radio layer 3) and RAN3 (Xn, N2/N3 NG-RAN) TSGs, targeted by nearly 30% of the projects. Significant interest, finally, is shown towards SA1 (Service and Feature requirements) and SA5 (Telecom Management) TSGs (20%+). These results are illustrated in **Figure 3**. Some details on specific **achieved impacts** body by body are provided in the following sub-sections 3.1 – 3.6. The full list of projects' standard contributions is available at the Standard Tracker online tool <https://global5g.org/online-tool-standards-tracker>.

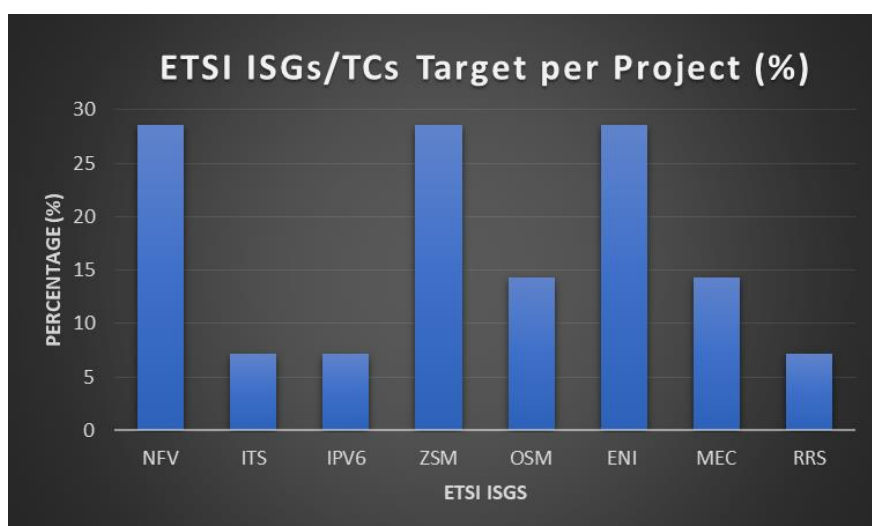


Figure 2: Percentage of Projects targeting each ETSI ISG

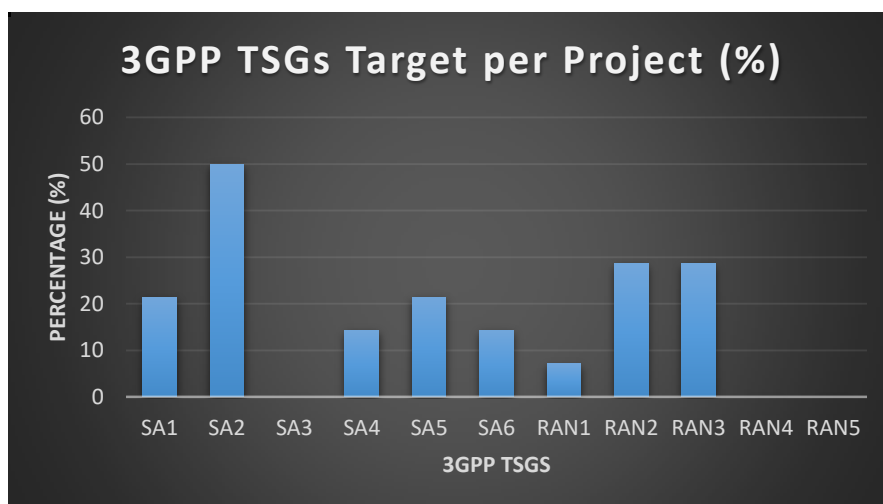


Figure 3: Percentage of Projects targeting each 3GPP TSG



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### 3.1. Pre-Standardisation Bodies (NGMN, 5GAA, 5G-ACIA)

Some notable interest towards 5GAA and 5G-ACIA associations was recorded by the survey. The expected role of 5G as enabler for vertical industries, and the relevance of automotive and industrial communications use cases is a plausible explanation for such attention. In particular, the impact of **5G Croco** on 5GAA was remarkable. **Very significant** contributions have been delivered on a number of Work Items, both on the analysis or requirements and the specification of solutions, on Tele-operating Driving use case, Quality of Service and Safety related features. The project contribution to 5GAA is still ongoing and will continue across the whole project duration. **5G-CARMEN** also contributed to the “Network Reselection Improvements” cross-working group work item, addressing technical solutions for inter-MNO operation in V2X scenarios. On industrial communications, **5G-Smart** provided input to 5G-ACIA on Time Synchronisation and TSN, two key topics subject of hot debate necessary for 5G to integrate existing wired industrial communication technologies.

### 3.2. 3GPP

Due to the high attention devoted by most projects to 3GPP TGSs, a rich list of successful impacts emerged from the survey, on a multitude of technical areas and spanning across Release 15, Release 16 and Release 17. A **very strong** and coherent impact on satellite integration in 5G was achieved by **SAT5G**, which generated several hundreds of contributions to Release 15 and Release 16 Study Items, both during the requirements specification phase (SA1) and the architecture definition for satellite integration (SA2, RAN3). A **strong** impact was also achieved by **5G Croco** which, still focusing on technologies relating to automotive industry, delivered research results to SA2 and SA6, on Release 16 and Release 17 Study Items relating to QoS, MEC, MNOs interactions and teleoperating driving. Still on vehicular communications, **5GDrones** provided some contributions to SA6 Unmanned Aerial System Study Item, on the interaction between Unmanned Aerial Vehicles and relating controllers. The attention to verticals manifested also with the contribution several projects made on studies relating to Non-Public Networks (NPN): on this side **5GVinni**, **5GEve**, **5G-CLARITY** and **5Growth** supported SA5 activities on NPN management. A strong impact was achieved by 5GVinni to Release 16 and Release 17 Study Items of NPN management relating to concepts, use cases and requirements of management on NPN. **5G-DIVE** project contributed to 3GPP SA2 on the edge computing feature. Other projects have also been contributing to various 3GPP TSGs on a plurality of areas, a significant example being **5G-Tours** whose contributions were delivered to SA1, SA2, SA4, RAN1 and RAN2, on Multicast Broadcast solution, Slice Service Level Agreement, NB-IoT, NR light and UL/DL scheduling.

### 3.3. ETSI

Several projects significantly contributed to ETSI ISGs. Some notable examples are provided in the following: On NFV ISG, **5G Carmen** proposed a CCAM architecture for the management and orchestration of specific use cases with different service requirements, with special emphasis on mission critical and low-latency service instances that require support of the 5G Infrastructure. Several contributions have been provided, that have been captured in the ETSI GR NFV EVE017 "Real-time/ultra-low latency aspects report". **5GENESIS** proposed a new Syntax Validation for Descriptors and Standardized format for remote NFV repositories to OSM Release 8. On ZSM ISG, **5G Vinni** and **5G Eve** contributed to the definition of Closed-Loop automation architecture for analytics driven service automation, as well as network slicing automation for vertical integration. **5GVinni** provided some contributions to Network Slicing Landscape



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(ZSM004) and Closed-loop automation (ZSM009), on the ZSM relationship with OSM and closed-loop automation use cases for performance optimization. . On MEC ISG, 5G-DIVE, 5GROWTH, and 5GCLARITY contributed to MEC to a new study ETSI GR MEC 036 “Study on MEC in resource constrained terminals, fixed or mobile” which launched recently (July 2020). On ENI ISG, **5G-Tours** contributed on Autonomous Slice Management for Verticals. On TC ITS, **5G Croco** contributed to ITS Architecture extensions using Cellular infrastructure and Interoperability as well as C-ITS Security areas. Still on vehicular communication 5G Mobix contributed to a white paper on IPv6-Based Vehicular Networking.

### 3.4. IETF / IRTF

5GROWTH, 5G-DIVE and 5G-CLARITY, leveraging on the work done on Orchestration of constrained, mobile and volatile resources, Service Function Chaining control; Function migration and orchestration in fog environments; Pseudo-deterministic behaviour in wireless networks for Industrial IoT and Dynamic discovery and advertisement of resources in edge networks provided strong contributions to several IETF WGs, including SFC, ANIMA, DMM, RAW, DHC, NMRG and COIN RG. 5G-EVE and 5GENESIS contributed to IETF BMWG on 5G transport network benchmarking and 5G-EVE contributed to IRTF NMRG on transport slice intents. 5G-CARMEN contributed to IETF DMM on Control-/Data-Plane for N6 traffic steering, focusing on the applicability to MEC in Automotive Use Cases.

### 3.5. IEEE

On IEEE standard diverse solid contributions have been proposed by several projects. 5GENESIS, on Advanced Dynamic Spectrum Allocation, submitted input papers to IEEE SA-P1932.1; 5G-Growth and 5G-Dive, on time sensitive networking and its profile for industrial networks, submitted multiple contribution to IEEE 802.1, IEEE 802.11bc, and IEEE 802.11be; finally, 5G-Clarity contributed to , IEEE 802.11bb, on LiFi technology and Positioning.

### 3.6. ITU

Significant impact was also achieved within ITU. Notable results include SAT5G contribution to ITU-R, NGAT\_SAT Work Item, where the project led definition in ITU-R and CEPT of satellite roles in 5G in ITU-R M.2460-0 “Key elements for the integration of satellite systems into Next Generation Access Technologies”. Very significant also 5G-SMART contribution to the Time Synchronisation topic, within ITU - ITU-T SG15, with the submission of contributions towards the development of recommendations series G.8272, G.8272.1, G.8275, G.8273.2 and G.8271. Forward looking, 5GEve proposed contributions to the ITU-T Focus Group 2030 on testing facilities for 5G and beyond 5G.

## 4. Success factors

A quick analysis of sections 3.1- 3.6 shows all projects managed to contribute to some SDOs which, considering the huge effort needed to transfer concepts and technologies to standards, is a clear evidence Horizon 2020 projects devoted significant effort and paid high attention to the exploitation of their research results in standardisation perspective. In particular, some projects, appear to have had impressive influence on standardisation activities, and the survey allowed to identify the reasons behind their achievements. When asked on the key factors behind their success, most project representative put in the first place **the presence within the project of researchers with strong experience in standardization and engagement in the relevant working groups**. This ensured projects to own professional skills and know-



how necessary to execute research to standards technology transfer. Furthermore, according to the survey, the second ingredient leading to success relates to **the project scope and its relevance in standardisation perspective**: projects having their goals somehow aligned to the objectives of standardisation working groups and study/work items could easily find stakeholders within SDO for their results. For example, some projects reported as beneficial the alignment of the items subject of research to working areas SDOs flagged as “for further study”. Finally, essential to success was also a **good understanding of existing standardization roadmap in the project proposal phase**: projects which managed to produce their results with the right timing with respect to standardisation roadmap had more chances to work towards technology transfer to SDOs. Notably, a minority of projects also mentioned the capability of realizing proofs of concept to validate technology evolutionary paths as an element facilitating impact to standards.

## 5. Improvement Points

The list of success factors from section 4 already provides the basis for improvement actions future projects may undertake. First, in the consortium creation, ensuring the **participation of companies and skilled professionals engaging with the relevant standardisation bodies**. Second, in the project scope and objectives definition, ensure the **presence of actives and objectives which may generate standard relevant concepts or technologies**. Third, analyse project plan with respect to the expected standardisation timeline, to ensure **timing alignment allowing results to be produced timely to be delivered to SDOs or even to foster the inception of new standardisation initiatives**.

It is worth noting that, when asked on the major hurdles faced during the attempts to deliver results to SDO, most respondents to the survey mentioned the timing issue: they experienced problems as, quite often, the results were available too late with respect to the timeline of standardisation study and work items.

## 6. Conclusions and Recommendations

The significant response to the survey, contributed by projects on voluntarily basis, allows to draw some solid conclusions and to draft some recommendations to the benefit of the next EU Research Framework Programme and future projects.

The importance of standards to strengthen the industrial relevance of research projects emerges clear from the high number of respondents to the survey (**14 projects**), the multiple standardisation bodies most projects declared interest in (on average, interest for nearly **4 SDO per project** was declared), and the long list of bodies of interest (**12 SDOs**). Despite the long list and the heterogeneity of SDOs for which interest was declared, **ETSI and 3GPP** appear to be by far the privilege targets, as around **80% of the respondents** to the survey declared achieved and/or planned impact on both ETSI and 3GPP. The reason behind this preference may be inferred considering the strong presence in the project consortia of mobile network operators and telecom equipment vendors, for whom both ETSI and 3GPP have tremendous business relevance, both in commercial and technological perspective.

The survey brought to light remarkable results from several projects, some of which achieved significant impact, both in terms of **amount of submitted standard contributions** and **overall influence on 5G standardisation activity agenda**. However, the survey also highlighted not all projects achieved impact of



the same magnitude and significance. For this reason, the survey data has been analysed to identify possible improvement points and formulate recommendations to future projects of the next EU Research Framework Programme.

A review of the reasons behind the success of the best performing projects, boosting the transfer of their research results to SDO, led to identifying following common **success factors**:

- the participation to the project of **researchers with strong experience in standardization** and engaged in the relevant standardisation working groups;
- the relevance of the **project scope** to standardisation bodies scope and objectives;
- a good understanding of existing **standardization roadmaps** during the project proposal preparation.

On **weakness** side, the **bad timing of research results**, reaching maturity too late to be fed into relating standardisation activity, has been a recurrent factor reported by the respondents.

In their simplicity, the survey conclusions allow to formulate **two** clear and easy to implement **recommendations** to improve the performance of future projects **with standardisation impact ambitions**:

1. during the **project preparation** phase,
  - A. the **research objectives** formulation (“what” to produce) and the **project time plan** definition (“when” to deliver) shall consider the expected standardisation timeline of the target SDO research results should be transferred to;
  - B. the **project consortium** composition shall ensure a **significant presence** of both organisations and researchers with **solid standardisation expertise**;
2. during the **project execution** phase, project members shall ensure timely **engagement in the relevant SDO activities**, with timing and format coherent with the project standardisation objectives.

Finally, to facilitate the application of the above recommendations, further actions will be taken by 5G-IA Pre-Standardisation WG. In particular, an activity has been triggered aiming at defining a **B5G/6G Research and Standardisation roadmap** which, **upon a reasonably expected standardisation timeline for the next decade, will identify the area of research to investigate, the type of research results to generate and their ideal timing**, to facilitate a successful delivery to the relevant standardisation bodies.