5G smarT mObility, media and e-health for toURists and citizenS

Deliverable D8.2
Second Report on Innovation Management, Dissemination, Standards and Exploitation Plans

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Editor(s):	Ran Rahav (LIV)
Author(s):	Simon Fletcher (RW), Anthony Dunne (RW), Eleni Rigani (NOK-GR), Cédric Thiénot (EXP), Carlos Barjau Estevan (UPV), Eric Gatel (BCOM), Mathieu Lagrange (BCOM), Guillaume Pasquier (BCOM), Giovanni Nassi (TIM), Panayiotis Verrios (ACTA), Simos Symeonidis (ACTA), Efstathios Katranaras (SEQ), Ran Rahav (LIV), Marco Gramaglia (UC3M), Ana Hernandez Llor (UC3M), Albert Branchs (UC3M), Belkacem Mouhouche (SRUK), Vignaroli Luca (RAI), Yevgeniya Sulema (BLB), Roman Odarchenko (BLB), Nelly (Eleni) Giannopoulou (WINGS), Vera Stavroulaki (WINGS), Ioannis Stenos (WINGS), Amalia Ntemou (WINGS), Charalabos Korovesis (WINGS), Manos Danis (WINGS), Marika Antonopoulou (WINGS), Fons de Lange (PRE), Nikolaos Papagiannopoulos (AIA)
Reviewer(s):	Nelly Besnard (CHU), Cédric Thiénot (EXP), Francesco Curci (TOR), Gregory Milopoulos (EA)
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List of Acronyms and Abbreviations

3GPP	3rd Generation Partnership Project
5G	Fifth Generation
5G-EVE	European 5G validation platform for extensive trials
5G Mag	5G Media Action Group
5G-MoNarch	5G Mobile Network Architecture for diverse services, use cases, and applications in 5G and beyond
ABM	Account Based Marketing
ABR	Adaptive Bite Rate
AR	Augmented Reality
AIA	Athens International Airport
API	Application Programming Interface
ATSC	Advanced Television Systems Committee
B2B	Business to Business
BMC	Business Model Canvases
BMSB	Broadband Multimedia Systems and Broadcasting
BSS	Business Support System
BVME	Business Validation and Models Ecosystem
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CARS	Computer Assisted Radiology and Surgery
CDN	Content Delivery Network

CHU	centre hospitalier universitaire (French)
CIoT	Cellular-IoT
CMUT	Capacitive micromachined ultrasonic transducers
COVID	Coronavirus disease
CPNF	Control Plane Network Function
CSP	Communication Service Provider
DAS	Distributed Antenna Systems
DG Connect	Directorate-General for Communications Networks, Content and Technology
DICOM	Digital Imaging and Communications in Medicine
DSL	Digital Subscriber Line
DVB	Digital Video Broadcasting
E2E	End to End
ECG	Electrocardiography
EDEN	European Distance and E-Learning Network
eMBB	enhanced mobile broadband
ENI	Experiential Network Intelligence
EnTV	Enhancement for TV service
EPC	Evolved Packet Core
ESEA	European Science Education Academy
ESHA	European School Heads Association

ETSI	European Telecommunications Standards Institute	*IPR*	Intellectual Property Right
ETSI ENI	ETSI Experiential Networked Intelligence	*IPWC*	International Wireless Industry Consortium
EUCNC	European Conference on Networks and Communications	*IVR*	Interactive Voice Response
		KPI	key performance indicators
FeMBMS	Further evolved multimedia broadcast multicast service	*LAN*	Local Access Network
		LTE	Long-Term Evolution
FOBTV	Future of Broadcast Television	*MANO*	Management and Orchestration
GIANT	Global Innovation And New Technology	*MB-SMF*	Multicast Broadcast SMF
		MB-UPF	Multicast Broadcast UPF
GPCI	Global Power City Index		
IATA	International Air Transport Association	*MBMS*	Multimedia Broadcast Multicast Service
IBC	International Broadcasting Convention	*MBS*	Multicast/Broadcast Service
		MEC	Mobile Edge Computing
ICNIRP	International Commission on Non-Ionizing Radiation Protection	*mMTC*	massive Machine Type Communications
ICT	Information and Communications Technology	*MNO*	Mobile Network Operator
		MSP	Mobile Service Provider
ICU	intensive care unit	*MVNO*	Mobile Virtual Network Operators
IEEE	Institute of Electrical and Electronics Engineers	*MWC*	Mobile World Congress
IEEE JSAC	IEEE Journal on Selected Areas in Communications	*NB-IoT*	Narrow Band – Internet of Things
IFE	In-Flight Entertainment	*NEMO*	Network of European Museum Organizations
IHE DEV	Integrating Healthcare Enterprise devices	*NFV*	Network Functions Virtualisation
IMD	International Institute for Management Development	*NGMN*	Next Generation Mobile Networks
		NPN	Non-Public Network
IMT	International Mobile Telecommunications	*NWV*	New Work Proposal
		NR NSA	5G new Radio non-Standalone Mode
IoT	Internet of Things	*OPEX*	operational expenditure
		OSS	Operational Support System
IIoT	based Industrial IoT	OSM	*Open Source Management*

OTT	over-the-top		UTRAN	Universal Terrestrial Radio Access Network
PCHA	Personal Connected Health Alliance		V2X	Vehicle-to-X
PHY	Physical Layer		VPN	Virtual Private Network
POC	Proof Of Concept			
PON	Passive optical network		VR	Virtual Reality
RAN	Radio Access Network			
RAT	Radio Access Technology		WebRTC	Web Real-Time Communication
RGB-D	Red Blue Green and Depth			
ROI	Return on Investment		WG	Working Group
SCN	Small Cells Networks		XR	eXtended Reality
SDK	Software Development Kit			
SIB	System Information Block			
SEM	Search Engine Marketing			
SEO	Search Engine Optimization			
SEP	Stakeholder Engagement Plan			
SID	Study Item Description			
SLA	Service-Level Agreement			
SME	Small and Medium-sized Enterprise			
STARLIT	cloud baSed ioT smARt LIving platform			
STD	Standardisation			
TETRA	Trans-European Trunked Radio			
TIP	Telecom Infra Project			
TSG	Technical Specification Group			
TSN	Time-Sensitive Networking			
UHD	Ultra High Definition			
uRLLC	Ultra-Reliable Low-Latency Communication			
UPF	User Plane Function			
USSD	Unstructured Supplementary Service Data			

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Executive Summary

With the empowering European Vision of "**5G empowering vertical industries**" 5G-TOURS reports at the conclusion of its second year of project activities on dissemination, innovation and exploitation planning outcomes. The 5G-TOURS engagement in the vertical industries is shown by the diversity of its project partners drawn from the vertical sectors that provide the focus of the value creation alongside project partners from the wireless industry. The three themes; the Touristic City (hosted by Turin, Italy), the Safe City (hosted by Rennes, France) and the Mobility Efficient City (hosted by Athens, Greece) encompass not only technical platforms and solutions that are under development, but a wider socio-economic and business context.

Work Package 8 (WP8) of 5G-TOURS manages the processes necessary to fulfil the project's objectives of **Business validation and exploitation**. To this end, WP8 operates four processes of Business Case Analysis, Exploitation and Innovation Management, Standardisation and Industrial Communications and Dissemination. This report provides a summary of the outcomes to date towards dissemination, standardisation and impact assessment in the second year of the project. Each year the project partners take the opportunity to review their exploitation planning and refine their strategy towards exploitation of the outcomes of the project. The refreshing of the strategic thinking of the project partners is essential and exactly maps the approach that would be taken in agile technology sectors where strategic marketing, technology and business model insights will necessitate strategic pivots.

Business Case Analysis has focussed in the second year on a refinement of the approach to stakeholder management and ensuring that appropriate contacts are in place for the support of the validation of the project findings when thinking about internal workshop as well as seeking opportunities to promote the project findings at conferences and in publications. Having researched business model views in the first year, the second year has seen the refinement an approach to the cost models as well as joint work with the WP2 on economic value creation. This results in decisions regarding the deployment network models and supporting business cases that will be investigated in the final year of the project for each of the value creating networks and use cases under investigation in 5G-TOURS.

Exploitation and Innovation Management has, through the use of the innovation process approach developed in year one (4Ps), established a view on emergent innovations that will be promoted by the project. This now includes an approach that promotes the championing of innovations by the project partners by way of the exploitation planning and statements of the project partners. The project is also steering its activities in terms of standards, IPR and business analysis to help the project partners to realize the commercial potential of the project key innovations.

Standardisation shows a positive evolution of the impact, a principally 3GPP focussed view in year1, towards a diversification of the standards that are being contributed to in year two. This diversity of contribution includes industry fora such a 5G Media Action Group (5G-MAG) where members of the project are now in leadership positions. These industry steered organisations influence the priorities and emergence of technical features from standards such as 3GPP, but also stimulate the need for trials and use case testbeds, which the project is well positioned to influence given the testbed capability of 5G-TOURS.

Industrial Communication and Dissemination have established the necessary internet presence through website, linkedIn, YouTube and Twitter. In the second year, the emphasis remains on conferences and papers (although to some extent curtailed as a result of COVID-19) but showing some agility to adopt new approaches to dissemination through the use of online webinars for selected use case and technical topics. The volume and quality of media content has substantially increased as testbeds have come online during year two. All inter-5G-PPP project working groups have resource from 5G-TOURS allocated. Chair, vice-Chair and founder member positions are credited to various partners of 5G-TOURS, providing substantial evidence of engagement in the wider 5G-PPP community

Now over one year into the global crisis that is COVID-19; 5G-TOURS has retained a high level of output to the Standards. Year two was principally involved the deployment of the testbeds and small scale testing activities which, with some restrictions, were able to proceed. The continuation of COVID-19 into year three of the project remains a risk in terms of the WP8 performance metrics; however, a new normal of predominantly online interaction has been established as the norm and had less impact on this activity area than was feared at the end of year one.

1 Introduction

This report is the second statement from Work Package 8 (WP8) of 5G-TOURS at the end of the second year. The Business validation and exploitation objectives of WP8 are structured around four key process areas as defined by the tasks. Ultimately our objective is to establish outcomes focussed towards the enablement of the verticals in the 5G ecosystem combining each of these elements.

- Business analysis tested against stakeholder perspectives illustrating commercial potential of the project results
- Innovation processes to help shape project activities towards commercial potential.
- Standards and IPR strengthen the commercial value and potential impact of the project
- Industrial communication enables the reach of the project concepts to influence the emergent market

Task8.1 carries out Business Case Analysis on behalf of the project. This amounts to applying business analyst thinking to establish credible commercial cases. By strategic market studies in the vertical sectors, exploring evolving value chains and commercial models. This report highlights initial findings on the state of the art of business models emerging in the 5G domain and the insights gained from a project partner survey. To frame the potential relevance of commercial models in the context of a City environment a survey of City Indexes enables analysts to determine City level motivations.

Task8.2 co-ordinates Exploitation and Innovation Management focussed activities. All partners have been given the opportunity to review and refresh their view on their strategic thoughts regarding exploitation of the outcomes of the project. The Innovation Managers (one for each of the testbed themed areas) have developed an initial view on the value propositions of the use cases and the wider market expansion models that could be relevant as the project progresses.

Task8.3 co-ordinates the Standardisation activities of the 5G-TOURS partners. Standards bodies such as 3GPP and ETSI are a principle beneficiary of the contributions from partners but other Standard Development Organizations (SDOs) such as DICOM (Digital Imaging and Communications in Medicine) are also relevant 5G-TOURS tracks developments with respect to slicing from Next Generation Mobile Networks (NGMN) and is exploring the limitation of the templates published by them in regard to the requirements of the vertical industries addressed in the project (mobility, tourism, health). This may lead to influence and shaping of those templates over time.

Task8.4 co-ordinates Industrial Communication and Dissemination for the project. A marketing plan is provided that seeks to identify major targets of the project. The report also highlights achievements to date with respect to event contributions and the creation of assets for the project; social media channels, website, video and brochure and flyer templates that can be exploited over the coming two year of the project.

This report is structure around the above task and process areas:

- **Chapter2:** Provides a summary of the Business Model context for the project.

- **Chapter3:** The Exploitation plans of the project partners are individually presented, and then further analysis is carried out to determine synergies and patterns with respect to the vertical and value chain structures inherent in the 5G-TOURS project consortium.

- **Chapter4:** The approach to Innovation is identified and findings from the preliminary analysis of the Innovation Managers with respect to the use case driven opportunities and the market expansion trends that will frame emergent innovations into the vertical.

- **Chapter5:** Standardisation outcomes to date and expectations with respect to Intellectual Property that may be generated in the project are captured in this chapter.

- **Chapter6:** Identifies achievements to date for dissemination and sets out focus for the next period.

- **Chapter7:** Conclusions for the second year of the project from the perspective of WP8.

2 Business Model context

A key objective of WP8 is to develop and validate business models for each of the markets addressed by 5G-TOURS (i.e., touristic, media and entertainment, e-Health, safety, transportation) using contributions from the other work-packages.

The business models will help with directing the economic impact of the project, in particular the industrial sectors (market verticals) that adopt 5G as a platform for the delivery and use of products and services.

An initial review of current business models [33] identified a number of templates that have been used to analyse typical innovations brought by 5G. However, none had thus far been applied to specific use cases such as those considered in 5G TOURS. Having now considered both the state of the art in terms of the technical research of 5G-TOURS and Business Models that are relevant for 5G, year2 was period of grounding based on stakeholder engagement in the verticals to ascertain the gap between their reality of business challenges today and the aspirations of 5G-TOURS in bringing value to them. This activity has necessitated close co-operation with WP2 benefits analysts to derive and start the validation of method that is accessible to verticals to understand the potential of the innovations that are coming towards them through new network and device products and supporting services.

The 5G-TOURS business model framework starts with business case analysis of individual use cases to better understand those that have the potential for the greatest value creation in each market. In this period we have been working closely with WP2 to develop a framework that aims to establish the value generation potential of the use cases. Figure 1illustrates where T8.1 fits in the overall techno-economic assessment being conducted by RW across the various 5G-TOURS tasks.

The most promising business cases are developed for each vertical use case to quantify their specific value. This information will be used to inform the identification and selection of appropriate business models for the deployment of 5G infrastructure in each of the operating environments (airport, city, hospital). These business models describe how organizations in each vertical can create, capture and deliver value, which is derived from 5G, in economic, social, cultural and other contexts. This can then be used by the project partners and other stakeholders to clarify their role in the vertical use case value chain which and how this can drive strategies for the commercial exploitation of project results.
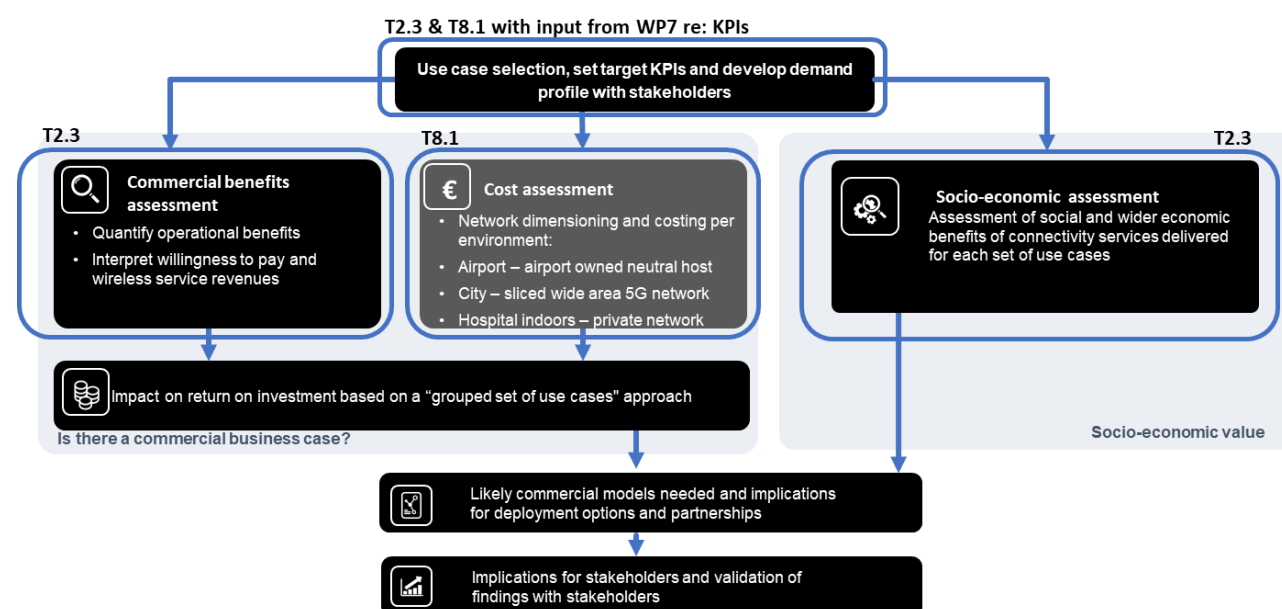
Figure 1. 5G TOURS Techno-economic assessment approach.

During this period, 5G-TOURS business model analysis has enabled significant contributions in the 5G-PPP collaborative project domain supporting the formation (and holding of the vice-chair position) of the **B**usiness **V**alidation, **M**odels and **E**cosystem (BVME) sub-group of the 5G-PPP Vision group. This group published its

first paper in mid'2020 [1] establishing consensus on the diversity of approaches taken by 5G-PPP projects and ensuring the compatibility of the 5G-TOURS approach with that BVME collective view. 5G-TOURS now has a common understanding of the approach taken across other 5G-PPP projects. We have concluded that the approach taken in 5G-TOURS aligns with the this process model and thus conclude that we are progressing using an approach that would be recognised as business validation in the 5G-PPP ecosystem.

Figure 2. Business validation approach for H2020 vertical use-cases [1].

We continue to contribute to the BVME group now looking at articulations of the 5G ecosystem concept.

2.1 5G-TOURS Business Analysis Framework

One of the main outcomes of the initial literature search was to determine that established business models do indeed have the potential to capture the characteristics of 5G products & services, however it was also evident they would need extensive modification to do so. Even with such modification it is not clear that any of the existing models could be adapted to meet the requirements of all verticals, or across the range of 5G TOURS use cases.

What is needed are a variety of business models that are able to encompass B2C, B2B & B2B2C channels and to accommodate additional stakeholders. In addition, it is important to identify models that accommodate vertical specific service characteristics and that can exploit synergies in the coverage, quality and capacity needs of different 5G products and services. Furthermore, it is important to recognise that the various use cases present opportunities for value creation and capture but that those opportunities may not in themselves be justification enough for the required infrastructure investment. More likely, any investment will be based on the cumulative value afforded by a number of different but co-existent applications, and it is therefore essential to capture this feature of wireless infrastructure in the T8.1 activities.

What is clear is that there is no "one size fits all" approach to the delivery of 5G. Consequently, during this latest period we have been developing a framework for navigating the opportunities presented by 5G, which draws on a number of business models, but which also incorporates elements of corporate strategy, individual sector objectives and value delivery within the vertical markets and the wider society. The framework is provisionally titled the 5G Enterprise Pathfinder Framework.

A noteworthy inspiration for the 5G-TOURS: 5G Enterprise Pathfinder Framework is the ICT-19 mission of "Enabling the Verticals". The framework is built around the specific use cases associated with the 5G TOURS

project, but the intention is that it will be applicable in any context to better inform 5G technology investment decisions within a range of environments and organisations. Use cases are considered to be incremental to a core service offering built around a collection of uses and applications for which it should be assumed there is already a degree of infrastructure investment. Therefore, the additional investment that is required to create and capture the value of a specific use case is what is being assessed.

This framework is illustrated in Figure 3 and has been developed in partnership with the Innovation Managers. It guides the next stage of analysis as each of the three themed City contexts and platforms, the associated eco-systems and business models will be assessed in greater detail during the next phase of the project.
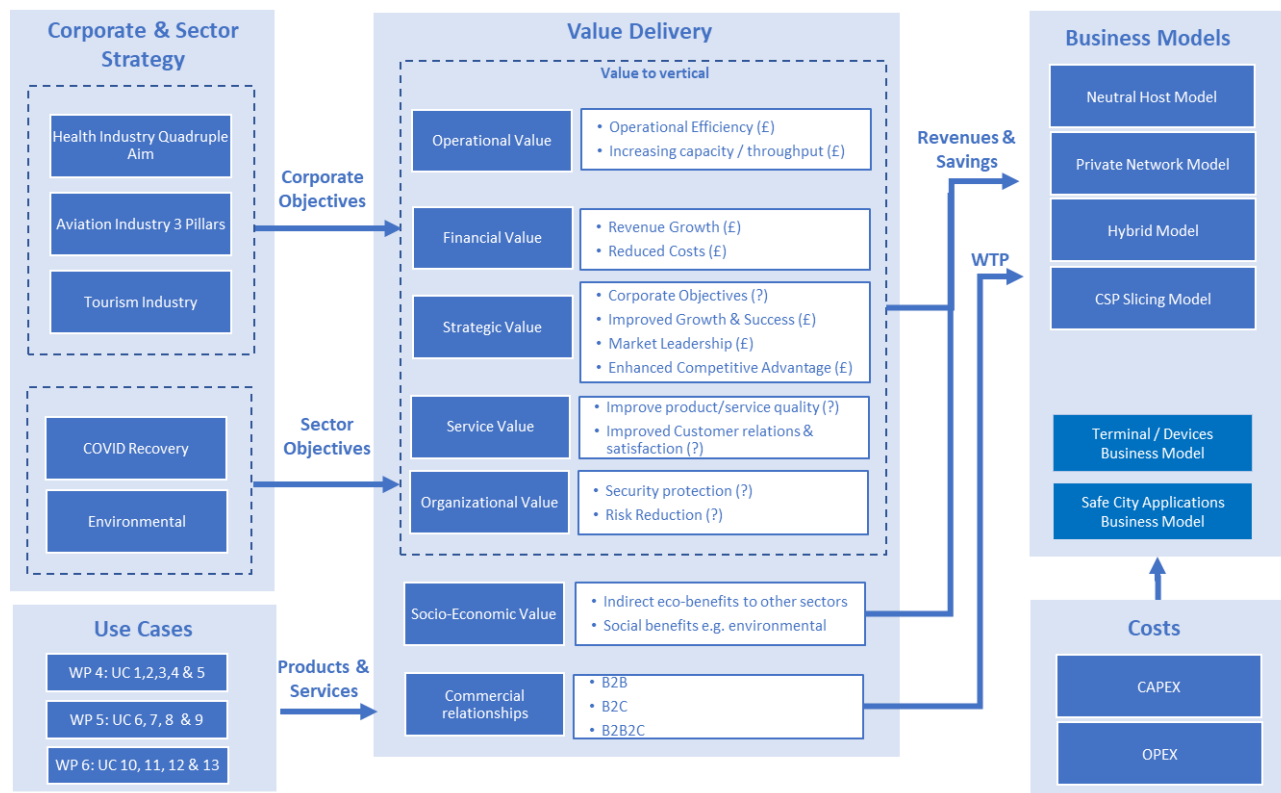
Figure 3. 5G TOURS 5G Enterprise Pathfinder Framework.

The sub-set of RAN business models underpinning the 5G Enterprise Pathfinder Framework for 5G TOURS are described briefly below, however the framework is intended to be flexible enough to accommodate other business models as necessary, particularly those that are yet to be developed or proven.

2.1.1 Private 5G Model

A local or non-public 5G network using 5G technologies to create a dedicated network with vertically optimised services and a secure means of communication within a specific area.

Appropriate spectrum is now starting to be released by national regulators. USA: CBRS (Citizen's Broadband Radio Service) [2], UK [3], France [4], Germany [5].

A number of Private 5G networks have been successfully deployed including, but not limited to:

Airports: Brussels, Paris, Helsinki, Vienna & Hamburg.

Hospitals: Sichuan Hospital

Manufacturing and Industry 4.0: OSRAM Factory, BMW plant in China, Mercedes Benz facility in Germany and Bosch at a factory in the United Kingdom.

2.1.2 Neutral Host Model

Neutral host infrastructure offers a shared platform which is open to all mobile network operators (MNOs) and supports various technologies, rather than each cell being focused on a particular MNO or technology.

They are usually deployed, maintained and operated by a third-party provider and are designed to support a wide range of MNO technologies/spectrum bands.

A variety of different neutral host approaches are used to provide premium wireless services in different environments, such as Distributed Antenna Systems (DAS) and Small Cells Networks (SCN). Typically, fibre-fed, these networks are designed specifically to cope with periods of peak user demand and scaled to accommodate future generations of technology, including 5G.

A Private 5G network might also be carried over the Neutral host infrastructure.

2.1.3 CSP Slicing Model

A CSP delivered service using dedicated network slicing for specific use case services over a wider geographical area. Network slicing enables the most economical model to provide service differentiation and meeting end user SLAs.

2.1.4 Hybrid 5G Network Model

The Hybrid 5G Network combines localised private networks with wider area coverage on a public network. This is attractive for UCs that have some overlap in coverage area between requiring dedicated localised resources and being capable of being supported to some degree over a wider area by transitioning onto a shared resource.

2.2 Use Case Architectures

Towards the end of last year, a number of meetings were held with the aim of conducting business model discovery "sprints". That is, to work with the various innovation managers in each area and derive a number of working assumptions relating to the solution architectures underpinning the various use cases and applications. These will be used to develop the business analysis framework in more detail and are intended to explore a number of the business models described above. The following details the principle outcomes of those sprints:

WP 4, Turin, Touristic City (UC 1,2,3,4 & 5)

- The CSP Slicing Model is being developed to support the WP4 Use cases.

- The anchor use case is UC 1: Augmented tourism experience.

- The broadcast specific use cases (UC 4 & 5) are being further evaluated to understand if the CSP Slicing Model can support wider "broadcast industry" services including "bonding".

WP5 Rennes, Safe City (UC 6, 7, 8 & 9)

- The Hybrid model (Private or Neutral Host network integrated with CSP Sliced network) will be developed for the hospital environment.

- CSP Sliced services will be modelled to deliver wide-area services in support of UC 6, 7 & 9.

- Private &/or Neutral Host models will be developed to support the high availability, high-bandwidth and low-latency requirements of UC8.

- The Private model will also be delivered to explore support for additional Hospital & Health business objectives (additional use cases).

- The anchor use cases are UC 7, Teleguidance for diagnostics and intervention support for the CSP Sliced service model & UC 8, Wireless operating room for the Private Network Model.

WP 6, AIA, Mobility Efficient City (UC 10, 11, 12 & 13)

- The Neutral Host Business Model is an established model for the Airport environment.

- It can accommodate CSP delivered 5G services to passengers and public as well as targeted Airport / Vertical specific services as demonstrated by Use Cases 10, 11, 12 & 13.

- A Neutral Host architecture can also support (shared infrastructure) the implementation of a Private 5G Network, by Airport Authorities, to support additional aviation business objectives.

- The anchor use cases are Use case 10: Smart airport parking management & Use case 12: Emergency airport evacuation for the Neutral Host Network.

2.3 Next steps 5G-TOURS business model framework

This latest phase of the project has seen the development of the 5G Enterprise Pathfinder Framework, which has been developed in close association with the project partners. The framework seeks to reflect and support the broad range of value creation and capture that 5G has the potential to deliver.

The framework very deliberately takes the perspective of organisations operating within the market verticals and is therefore designed to be flexible enough to support a wide variety of use cases, settings and business models.

We are confident that the framework will be a useful tool in helping organisations navigate the myriad of 5G deployment options, however, as yet it remains untested. The next steps, which will move the project towards a conclusion are to assess the business model inputs in more detail and create the narrative for the qualitative and quantitative analysis of 5G value creation in the 5G TOURS market verticals.

Initially this requires the development of a number of generic cost models that will provide reliable estimates of CAPEX and OPEX over a reasonable lifetime of the investment in the technology. In practice, one of the key elements of such an exercise is to quantify volumes of end users for each of the evaluation scenarios. This provides the basis for infrastructure dimensioning and costings.

As a first step, we have conducted an analysis of vertical and end user journeys at AIA (see Figure 4) in order to inform our estimation of 5G demand. These user journeys are intended to visualise and be accessible to non-5G experts with limited knowledge of networks provision but operational knowledge of their business. The intention is that this approach will be extended to the other environments and use cases in due course. Such an approach relies on accurate and timely information from a number of stakeholders, therefore it is imperative that we continue to have good engagement and commitment from the project partners to reduce uncertainties and maximise the appeal and practical benefits of this work, which will support the wider dissemination and exploitation of the project. Working in concert with the benefits analysts in WP2 a combined costs and benefits model will provide the ability for assessment of revenue potential and the ability to attribute costs (CAPEX and OPEX) for different business cases within assessment scenarios.
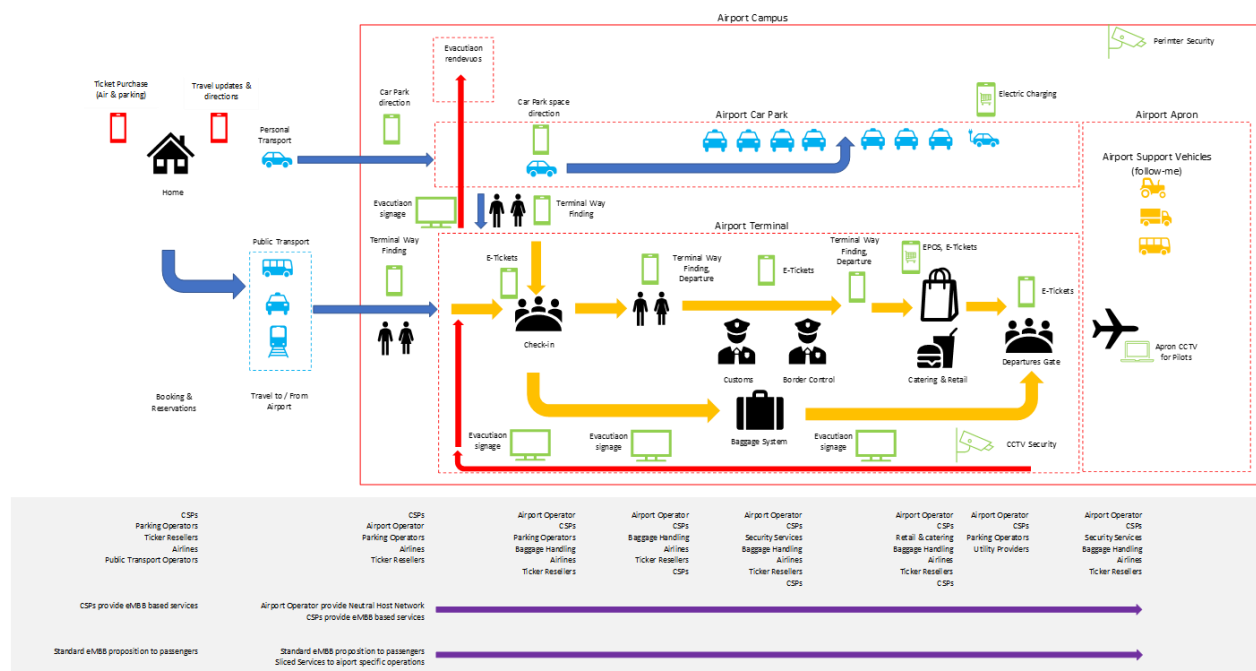
Figure 4. Airport user journeys.

2.4 Stakeholder engagement

Taking a consensus approach to establishing workable 5G Enterprise Pathfinder Framework is critical to the success of T8.1 and will underpin the credibility of WP8. Internal stakeholder engagement has been key and will continue to play a large part in the development of the value chain toolkit as we move into the final phases of the project.

Validation is also an important element therefore we have also been working to develop a Stakeholder Engagement Plan (SEP), which stimulates engagement with a wide set of external stakeholders, outside the consortium, but relevant to the 5G-TOURS vertical markets and the use cases that are being demonstrated. The process is described in Figure 5 below.
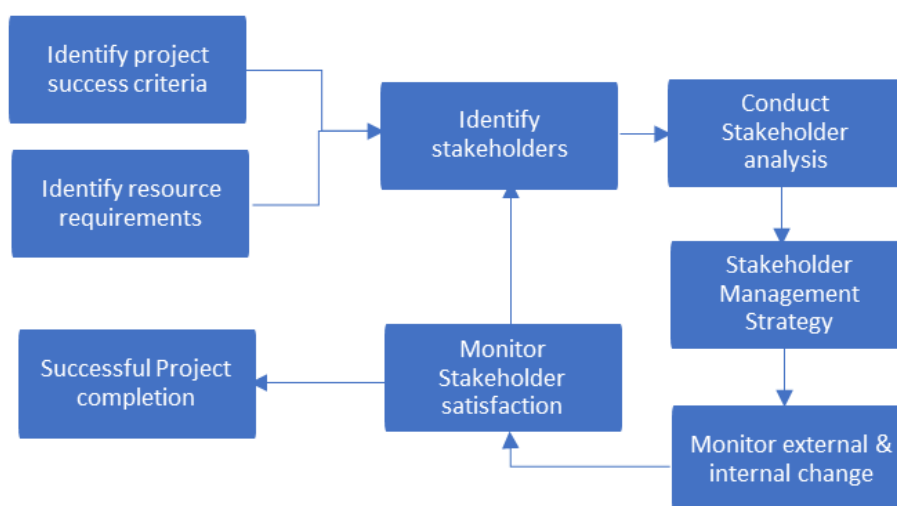
Figure 5. Stakeholder Engagement Approach.

Fundamentally the SEP captures, tracks and records stakeholders and industry players across the various vertical markets but it will also, ultimately, provide the target audience for future workshops (including the proposed trials workshops), surveys and validation activities.

The external stakeholder landscape is also critical for dissemination and exploitation, therefore, in parallel we have also developed a logical model for mapping of stakeholders to categories based on 5G service providers ecosystem roles (Figure 6).
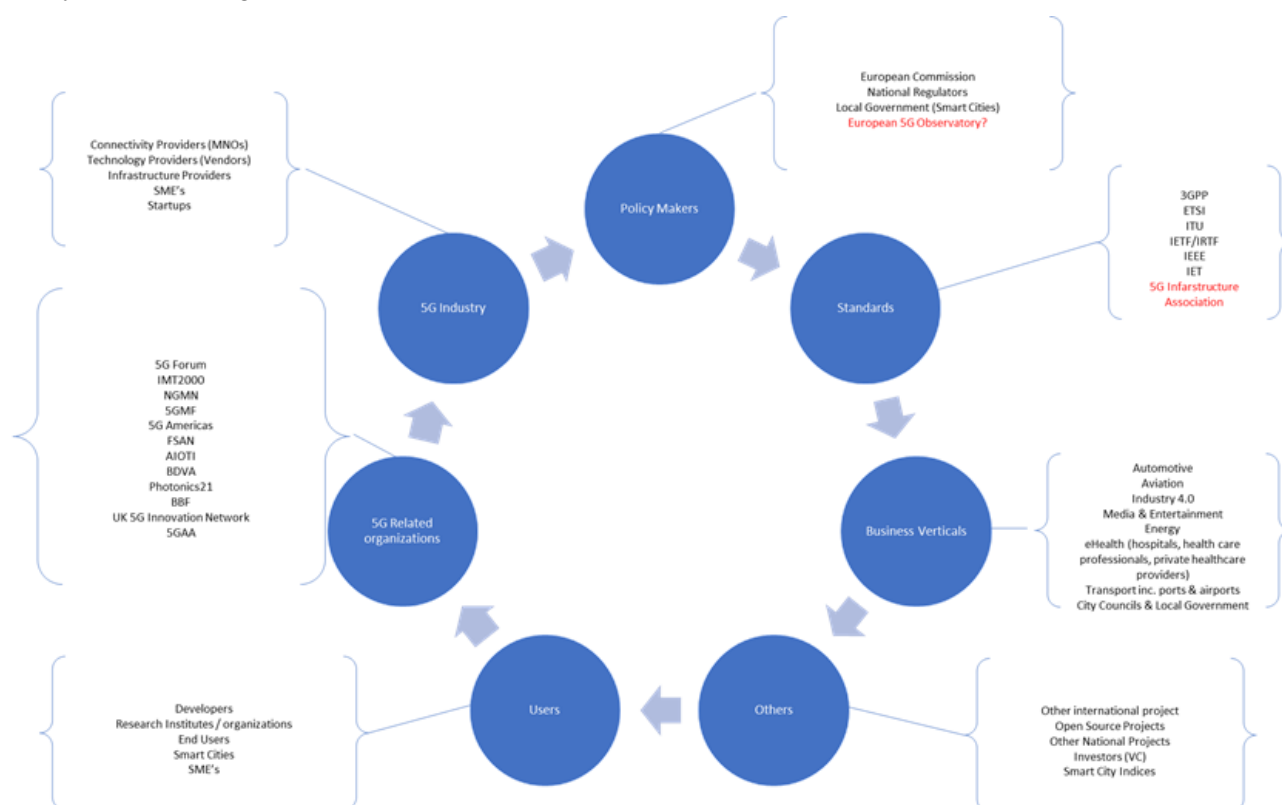
Figure 6. 5G-TOURS Stakeholder Model.

Once the important stakeholders have been identified and mapped, the core element of the SEP is the stakeholder analysis and review. By applying recognised business research methods, we have undertaken to implement this in two phases to capture the view before and after, which will help inform the degree to which stakeholders have improved their understanding of the potential of 5G as an enabler of value creation and capture.

An initial questionnaire was circulated among the members of the 5G TOURS consortium (and external parties) with the objective of characterising the ecosystem and to establish benchmark stakeholder views on the use of wireless technology & current business models before the trials. This focused on capturing perceived benefits versus today's pain points.

The intention is to follow up at or soon after the trial workshops with a second questionnaire to understand if the trial experience changes stakeholder views on use of wireless technology & appropriate business models. To that end the next step is to work with WP8 colleagues to align the external stakeholder landscape with the set of trials workshop attendees and finalise the second set of questionnaires.

On completion the stakeholder analysis can be revisited and finalised before drawing conclusions on stakeholder satisfaction towards the conclusion of the project.

3 Exploitation

This section describes the exploitation plans regarding the needed functionality linked to business cases to be developed by 5G-TOURS, considering, on one hand, the three dimensions of vertical ecosystems and, on the other hand, transversal network infrastructures.

In the following, the individual exploitation plans of 5G-TOURS partners are reported, subdividing partners on the base of their role in the project ecosystem: network operators, network equipment providers, the three vertical ecosystems (Media & entertainment, Healthcare and Mobility) and the Transversal activities.

As actual result of 5G-TOURS activities, some partners have developed/prototyped several products/services: at the end of this section a list is reported with the relevant information using the same short form requested by DG Connect questionnaire.

3.1 Mobile network operators

The role of the mobile network operators in the 5G ecosystem involves the deployment of the mobile network and the provision of network slices for the vertical customers (TIM, Orange, OTE).

TIM is the incumbent operator in Italy. TIM is implementing, and it will continue in the future, the plan "TIM for the cities of the future", which significantly impacts the business of the company. In the context of multi-year plans, 5G is a fundamental corner-stone, enlarging the type and number of markets where the new digital company will be committed and promoting the full deployment of the "native cloud" approach. The business with the so-called "verticals" is central in the 5G deployment. Therefore, TIM started already in the previous years with R&D projects and state-owned initiatives, such as the "Bari & Matera" trial supported by the Italian Ministry of Economic Development, and still today with the participation in relevant domestic development, such as "Casa delle Tecnologie Emergenti" in Torino, "Genova 5G - Smart Road" and "Florence Smart City" project.

5G-TOURS, which is running on top of the 5G-EVE platform coordinated by TIM, is a very important element in this strategy. Most of the innovative initiatives are centred in Turin, where TIM is planning to run the 5G-EVE platform in the so-called "Innovation Mile" area, aiming to implement the most innovative features of 5G beyond those that are going to be implemented in already foreseen commercial deployment. The involvement of players such as RAI, Comune di Torino and Fondazione Torino Musei provides TIM with the opportunity to create new businesses, consolidate link with these players and develop other solution in Italy in the field of broadcasting, smart city applications, education and tourism.

ORA: Orange is one of the world's leading telecommunications operators who is present in 29 countries. The Group has a total customer base of 250 million customers worldwide at 30 June 2016, including 189 million mobile customers and 18 million fixed broadband customers. Orange is also a leading provider of global IT and telecommunication services to multinational companies, under the brand Orange Business Services. Orange's R&D division is close to 8000 researchers, engineers, designers, developers, data scientists, sociologists, graphic designers, marketers, cybersecurity experts working to develop the solutions of the future, in all areas of digital transformation. As part of the open innovation strategy, Orange is also deeply involved in European and National collaborative programs, research partnerships with academics and industrial partners, and helps shaping the future by being active in the areas related to teaching and training.

Orange is proud to be part of the H2020 5G-TOURS project, enabling innovative 5G usage to its clients, and creating new opportunities for businesses curious on how to leverage 5G for their day to day operations. As a leader of Safe City use cases implementation, in collaboration with its local partners in the city of Rennes and its close vicinity, Orange is actively helping deploy the IT and telecommunication infrastructure backed by 5GEVE infrastructure, that will help deploy a state of the art Millimeter Wave 5G network to support healthcare related use cases. Orange in 5G-TOURS as a site manager for the Safe City node in Rennes, helps create a Hospital-centric 5G vertical ecosystem, where the focus of the technologies deployed is being at the service of the patients and the rapid care in case of emergencies.

Orange-PL, as a telecommunications operator, intends to use the experience gained with 5G-TOURS to offer new types of vertical services in the future. ORA-PL's 5G-TOURS activities are essentially focused on the orchestration of services and resources, mainly in relation to the Rennes site and UC7 and UC8, and the use of

Artificial Intelligence in optimising the operation of the 5G sliced network. We also attach great importance to the analysis of new business models being developed within the project and assume their use in the future business practice.

OTE along with its subsidiaries is one of the largest telecom groups in South-eastern Europe. OTE's ultimate goal is to formulate a strategy with respect to the timing for developing and offering 5G enabled end-user/customer services. OTE will exploit the 5G-TOURS project's results by gaining experience and accessing the maturity of the 5G technology and architectures (especially in a multi-vendor environment) so as to prepare for the formulation of its commercial strategy.

OTE will promote the project's results to biannual Deutsche Telekom Group (as active member of the DT Group) workshops, international workshops and congresses, which will greatly enhance and strengthen the dissemination opportunities for their wide adoption. Simultaneously, OTE will take care to disseminate and communicate progress of the 5G-EVE effort within the company as well as within the broader scope of the OTE Group of Companies.

Moreover, OTE will publish research papers in international journals and conferences in order to contribute to current standards, which is of crucial importance for the wide adoption and deployment of the 5G-EVE-related services.

In the scope of more concrete actions, OTE plans to organize dedicated sessions in events of major market and/or business impact either internationally (such as EuCNC, MWC, ICC) and/or nationally (i.e.: Infocom World Congress and Exhibition) potentially with booths for demos, as well as to organize at least two dedicated workshops in the framework of international events.

3.2 Mobile network equipment providers

The manufacturers of network equipment (i) provide the mobile network operators with the infrastructure to deploy their networks and (ii) supply the providers of the vertical solutions with the communication devices or components needed within their solutions.

Mobile network equipment providers exploitation plans include Ericsson Italy, Samsung, Nokia Greece, Expway Enensys, Sequans, ATOS Telecom.

Ericsson Italy is part of one of world's leader provider of communications technology (ICT) and services that enable the full value of connectivity by creating game-changing technology and services that are easy to use, adopt and scale, making its customers successful in a fully connected world. Its comprehensive portfolio ranges across Networks, Digital Services, Managed Services and Emerging Business; powered by 5G and IoT platforms. Ericsson Italy exploits 5G-TOURS results as part of its main goal to support operators and other "vertical" customers to leverage new business opportunities that rely on technologies enabled by 5G. Ericsson builds on the improvements on the state of the art brought by 5G-TOURS to strengthen its market position and to improve the product portfolio.

Samsung is the world's highest-selling mobile phone company and number one in global and European smart phone markets. Shortly after the beginning of the project, Samsung started producing 3GPP Release 15 phones. Samsung started providing project partners with these phones (Galaxy S10 model) and will continue throughput the project possibly with later releases (Rel-16). Samsung plans to exploit the project's results to strengthen its position in the smart phone market, improving their capabilities and reaching the verticals' markets. 5G-TOURS further provides an important opportunity for Samsung to enhance the global R&D in future 5G systems by cooperation with key vendors and operators, relevant verticals that can benefit from 5G, and leading research centres and universities across Europe. Samsung Electronics UK (SRUK) plans to utilise 5G-TOURS results and output for future development of Samsung 5G devices and networking products. Key innovative ideas included in the proposal are the suitability of 5G terminals for the diverse verticals covered in the project (i.e., media, e-health, mobility), terminal-based data analytics to help the management and orchestration of networks, as well as knowledge on 5G mobile network architecture, end-to-end network slicing and orchestration in 5G mobile networks that have expanded the company's competence towards mobile product developments in the near future. These innovations will be protected through international patents, whenever applicable. Samsung also builds on the project in order to continue improving the 3GPPP standard for future releases (16, 17 and beyond) including concepts studied in 5G-TOURS such as AI, Broadcast and network slicing.

Note: Samsung exploitation plans regarding media related activities are included within the media & entertainment segment.

Nokia Greece participates in 5G-TOURS with Nokia France. Nokia is interested in exploiting the results of the projects to improve existing business solutions, reduce capital and operational expenses of production labs, and provide potential for more economically efficient solutions and superior 5G products to customers. In addition, the results of the project are expected to be used to improve the design of the exposed interfaces, as well as the configuration parameters and options of the provided network equipment. Finally, the project results from the 5G testbed facilities are planned to be used to identify innovation opportunities in terms of solutions, products, and services for its customers. Within 5G-TOURS, Nokia leverages its network slicing products to deploy slices for medical and mobility applications. This gives insights about new business opportunities around these two vertical markets and provide valuable feedback on the resulting performance requirements and issues, which can be leveraged to improve the network equipment capabilities.

Expway Enensys plans to use the results of the 5G-TOURS project to enrich its portfolio to offer improved products to the broadcast market. First, Expway Enensys keeps its leading position in the current LTE-Broadcast market as Expway Enensys is the only end-to-end LTE-Broadcast provider to offer the solutions for both network and terminal. The outcomes of the 5G-TOURS project will strengthen Expway Enensys's position on 5G broadcast technologies to offer the solutions for the use cases targeted in the 5G-TOURS project and beyond. Expway Enensys provides the products and solutions that enable broadcast in 5G system in both core network and terminal. For example, the BM-SC product in LTE could be evolved and become network function(s) in 5G core network. Expway Enensys plans to provide the point-to-multipoint solutions for the convergence of fixed broadband (e.g., multicast ABR) and mobile networks (e.g. LTE-Broadcast) in 5G. Expway Enensys also intends to increase its standard exposure by actively participating in 3GPP SA4, SA6 working groups and occasionally other 3GPP working groups such as CT1 and CT3. Indeed, 5G-Xcast partners including Expway Enensys managed to introduce a study item on terrestrial broadcast in 3GPP Release 16. Expway Enensys plans to bring broadcast as a part of standard specifications in the upcoming 3GPP Releases.

Sequans leverages the project outcome to develop its knowledge of vertical markets, especially in the context of machine type communications. The improved knowledge on 5G-TOURS use cases can help Sequans to improve and add functionalities to its Cat-M and Cat-NB solutions, and enrich its product offering by including custom development made within the project, in order to adapt to the specific needs met in the various vertical deployments of 5G-TOURS. Technical activity undergone in the project helps us to continue promoting enhancements to LTE-M and NB-IoT technologies as well as scope development of IoT-relevant study and work items into 3GPP. Sequans exploits the project outcome to consolidate its transition from 4G to 5G, with a particular focus to the on-going trend in 3GPP of "Cellular IoT", including Industrial-IoT, reduced capability (Red-Cap) NR devices, or other evolution of eMTC and NB-IoT within Rel.16, Rel.17 and beyond.

ATOS Telecom is an international information technology company, leading the transformation of digital services and telecoms operators to generate more business value from their networks. The involvement in 5G-TOURS project plays a vital role to enhance the current portfolio of products and technologies offered to its customers. ATOS telecom portfolio is adapted for network virtualization and diversification of services. ATOS uses the knowledge and the expertise acquired during the 5G-TOURS project to strategically position the telco portfolio in an environment in which NFV is transforming the telecom landscape, strengthening its NFV Program. This project provides ATOS with the opportunity to be prepared for new customer demands and enable new business offerings. Building on the expertise gained during 5G-TOURS project, ATOS will analyse the return of investments of its customers that are willing to acquire 5G services.

As a member of the OSM, ATOS provides the knowledge, experience and contributions acquired in other EU funded projects such as SONATA or 5G-TANGO. ATOS Telecom facilitates the use of 5G-EVE through the 5G-TOURS service layer for the pilots that are being developed in the project, as well as extending the intelligent orchestration capabilities for the use cases of 5G-TOURS that are not offered from the 5G-EVE architecture.

Note: ATOS exploitation for media related activities is included within the media & entertainment segment.

3.3 Media & entertainment ecosystem

The media & entertainment ecosystem brings together partners that are providing the media solutions (Samsung media and ATOS media for AR/VR applications and LiveU for media production solutions) along with the users of those solutions: a museum and a school for the AR/VR solutions and a broadcaster for the media production (RAI Radiotelevisione Italiana, Comune di Torino & Fondazione Torino Musei and Ellinogermaniki Agogi).

Samsung media contributes to 5G-TOURS by members of the Samsung Internet Web Advocacy team. Among its main tasks is to spread the word about web technologies, with a strong focus on immersive AR/VR technologies. To do this, the Samsung Internet team engages in standards, contributes to open source projects and interacts directly with the developer community. Focusing on a more inclusive and diverse web, the Samsung Internet team treats topics related to the modern web, leading conversations in areas of Progressive Web Apps, Immersive Web, and new upcoming Web APIs. Samsung plays an active role in the Web and is committed to enhance the reach of these technologies. Through its involvement in 5G-TOURS, Samsung media expects to leverage the technologies developed within the project to greatly enhance the massively used Samsung Internet for Android, namely the web browser that is pre-installed on all Samsung Galaxy phones and tablets, so that it can be optimized to support immersive applications using underlying 5G technologies. That will be achieved through the open source Chromium project, to which Samsung is a major contributor. Also, Samsung expects to develop a better understanding of the use of AR/VR in use cases based on 5G infrastructure such as the transport of the touristic use cases to enhance the AR/VR products and improve the user experience in products such as the Gear VR.

ATOS media is a leading European provider of Managed Services and a major player in the area of IT services for large media companies and Olympic IT services provider. It plans to incorporate 5G-TOURS highlights into the media portfolio. In the media market, ATOS has customers in the Broadcast, Entertainment and New Media areas. The current portfolio of services includes: Media Operations Outsourcing, Process focused Digital Media Supply Chain Modernisation, OTT TV Services & Interactive TV Services, Sports Management Systems. The services are consumed by a large number of media players such as BBC where ATOS manages 151 international sites led by the BBC Network and over 1PB of web data distributed daily. ATOS explores the integration of 5G-TOURS results into its media offering portfolio enriching the already successful Olympic Video Player (a turnkey online multiplatform service providing a customizable digital Olympic experience) and into the ATOS Media Cloud services (with partnership with EMC2 and VMware).

LiveU leverages the 5G-TOURS project to tune and improve its video delivery algorithms and products for 5G networks. This is based on the knowledge it gains about new features offered by 5G technology in the areas of interest of a media company, including 5G network KPIs, QoS guarantee mechanisms and the impact of slicing, as well as the 5G ecosystem deployment preferences and priorities for media video contribution applications. LiveU exploits the project results for its cellular-based video contribution products serving the professional and semi-professional EU and global media customers in News coverage, Sports and Entertainment coverage etc. Further, LiveU remote production suite currently called "At home" for synchronized multi-camera production remotely from the cameras themselves, shall also be enhanced according to the 5G-TOURS tests.
LiveU uplink single and multi-link bonding video encoders-transmitters will be tuned for the performance we will experience in the 5G-TOURS testbed trials, such as in bandwidth, latency and error rate in the sub 6 GHz band. These products include the upcoming LU800, the existing LU600 and future products. Also, our LU-Smart SW for smartphones shall be similarly tuned for the 5G uplink performance. And as mentioned, so will the LiveU "At Home" remote production and future variations. LiveU will also be able to consider the impact of having its cloud-based video server receiver near the edge, for applications such as production using 5G Private Networks in venues.
LiveU collaborated with other partners of the project for the creation of state-of-the-art television products in order to exploit 5G-TOURS technologies in the area of the television production, taking into account UHD content, multi-camera synchronized production, low latency via edge server and additional collaborative production features such as multi-party return audio (later in the project).

RAI Radiotelevisione Italiana leverages the 5G-TOURS project to gain knowledge about new features offered by 5G technology in the areas of interest of a media company. RAI exploits the project results in two different areas: (i) the content distribution to the final user, enriching the television experience on different types of

terminals, and (ii) the television production, using the 5G network and features to implement remote and distributed production, facilitating the covering of events and exploiting 5G features by providing new services: from high quality audio/video streaming up to the mixed reality immersive services. In particular:

- Knowledge in IP-end-to-end highly distributed broadcast production workflow, cloud/edge-based video and audio encoding, mixed reality for improved TV entertainment;
- New TV formats enabled by new features offered by the 5G-TOURS technologies;
- Integration of the media company production workflow with new distributed edge network and computing technologies.

RAI collaborated with other partners of the project for the creation of state-of-the-art television products to exploit 5G-TOURS technologies in the area of the television production and in the area of distribution, taking into account UHD content and Immersive experiences in relevant cities. In this environment a focus of exploitation activities for RAI is about:

- Content creation and OTT services in the 5G era;
- Cultural heritage for touristic and museums services.

For the first point, the 5G technology is expected to build on and integrate the previous generations of wireless networks. 5G supports the expected broadcasters' mobile data growth, and at the same time to allow for new services for final users and advertisement. 5G brings network performance enhancements and agility in the network characteristics, and with that, plays an important role in supporting the growth and development of many industries, the broadcasting and media factories included.

For the second point about Cultural Heritage, RAI collaborated with the other Italian partners of the project in the production of new content specifically studied for the city of Turin in the context of 5G TOURS trials. In general, RAI will leverage the 5G-TOURS project to gain as knowledge about 5G service layer that will be valuable also for future works (research and industrial) in the environment of new generation networks.

Comune di Torino & Fondazione Torino Musei are interested in leveraging 5G technology to improve local services in the city. As stated within "Torino 5G Agreement", signed between the City and Telecom Italia, the City is particularly interested in exploiting the 5G infrastructure to evaluate future suitable applications. For 5G-TOURS the City is working on touristic, as well as on cultural and educational sectors, thanks to the collaboration with Fondazione Torino Musei: the five use cases provided in WP4 have, as main locations, museums. The objectives, are mainly: to increase the cultural and tourist offer of the city, to diversify the cultural offer of museums in order to reach the widest and most diverse audience, to engage students by stimulating their learning through innovative and participatory technological solutions, to foster social inclusion, to improve the surveillance and safety system in museums and to improve the communication system for citizens and tourist providing more information (e.g. weather conditions, density of people in different areas).

Ellinogermaniki Agogi (EA) is an innovative school which systematically takes advantage of emerging new technological opportunities to offer enhanced teaching and learning experiences, including the use of advanced telecommunications infrastructure and high-speed connectivity. The potential offered by 5G technologies for richer educational content and experiences everywhere, both within and outside the classroom, will be exploited by EA to realize its aim to turn the school environment into a smart campus, and enable richer learning experiences whenever students visit sites of educational interest outside the school premises. To this end, EA offers its school environment for the co-design and testing of future 5G applications for education, leveraging the user-centred approach of the 5G-TOURS project to produce AR-VR solutions for travelling students which will be exploited in real-life educational settings both during and after the funded period of the project.

3.4 Healthcare and safety ecosystem

The healthcare and safety ecosystem includes partners across the full health value chain, including clinical parties (hospitals, emergency care services), equipment and health service providers (ultrasound systems, smart glasses, remote health monitoring and collaboration services), mobile network operators and network equipment vendors (described above). Their detailed exploitation plans are as follows (Philips, AMA, Hospital of Rennes and WINGS).

Philips plans to use the results and experiences of the 5G-TOURS project to improve its range of connected care solutions across the full health continuum, see Figure 12.
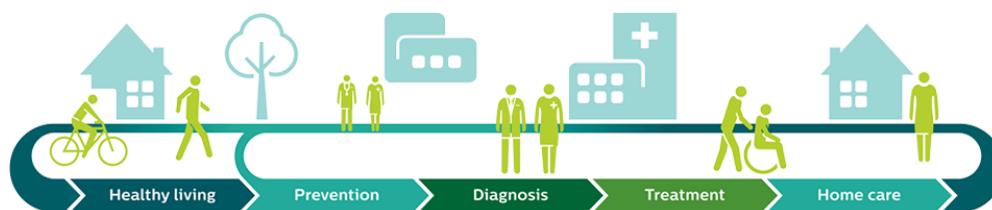
Figure 7. Health continuum.

A wide variety of connected medical devices are currently being used in the different phases of the health-continuum. These devices include mobile communication devices such as smartphones, patient monitoring devices such as respiratory and pulse rate measurement patches, vital signs sensing cameras, mobile point-of-care equipment such as ultrasound machines, data access / entry devices, such as tablets for use by nurses and techs in the ward, ICU and, radiology departments. Finally, there may be IoT devices for the monitoring of environmental conditions (temperature, light, motion) of patients, medication adherence, etc. 5G communication technology offers huge opportunities to create more reliable, performant and effective connected care solutions.

The use case that is addressed in 5G-TOURS is expected to provide valuable insights to Philips on how to effectively use 5G communication technology to improve and expand its business in Ultra Mobile ultrasound devices and solutions, in particular into the ambulance and the hospital emergency department. The combination of reliable real-time ultrasound streaming with low-latency remotely-controlled image acquisition, associated AR/VR applications, high resolution video communication and smart glasses will provide Philips the opportunity to create breakthrough product propositions for emergency care and diagnostics services for rural areas.

AMA plans to use all the experience gathered around 5G-TOURS to prepare the next big challenge that 5G represents on smart glasses business and tele-assistance. Today, AMA is leading this emerging market worldwide because it has the most robust solution working at its best even in low bandwidth conditions (3G, Satellite, etc.). Mastering its environment and being able to offer the best experience in any case, either low or very high bandwidth, is a key factor of success for any player in the smart glass business. This is why getting into this project helps AMA to be one step ahead than anyone else on 5G by bringing the best user experience and new features. This helps AMA to expand outside Europe too.

Hospital of Rennes (CHU) plans to use 5G-TOURS results to influence its project on the new hospital of the future. With more than 50 operating rooms, the interventional platform must have the most modern and efficient technologies. Augmented reality becomes a standard in OR and with the 5G-TOURS project, we expect 5G to provide the performances needed to actually combine two or more live sources of high-resolution image data in real-time. The synchronization needs to be perfect as in these situations time is distance and distance errors could be a matter of life and death during surgical minimally invasive interventions. Our hospital plays a major role in emergency and remote care with medical regulation teams and mobile emergency care teams. As part of the 5G-TOURS project, we will assess the performance of 5G to help transform an ambulance dispatched on an incident site into a real emergency room. All the expertise of the CHU will thus be used to assist and guide the intervention team to stabilize the patient on site and then during transfer to the hospital.
The benefits of 5G are also evaluated in the context of patient monitoring after or between hospital stays. The COVID 19 crisis we are exposed to in the present time contribute to stress the need for distant monitoring and distant access to medical expertise with the best connectivity available.
Positive evaluations will lead directly to changes in medical practices and care pathways.
Physicians involved in 5G-TOURS will disseminate the results in clinical and scientific conferences.

WINGS plans to exploit the outcomes of the project, especially the ones related to health, towards enhancing the company's software solutions, namely **STARLIT** so as to extend the supported set of connectivity options and to be able to offer the platforms services over a wide area connectivity offering, with certain quality guarantees. **STARLIT** is a platform for digital health and wellness based on artificial intelligence, IoT and wireless networking (Wi-Fi, 4G, NB-IoT, 5G). WINGS develops digital solutions (software and hardware) and transformations for various vertical sectors, namely solutions for the environment (air quality, natural disasters), net-

works and infrastructures (energy/water/gas, transportation, construction), production manufacturing (food, factories/logistics), service sectors (**health**, education/culture, government, security/defence). Through 5G technologies and the innovation developed in the context of 5G-TOURS, WINGS is enabled in maturing its products and consequently expanding its portfolio and becoming more efficient in its offerings.

For example, it is anticipated that WINGS will be enabled to deliver content and services for digital health, (currently, in the portfolio or new ones), by exploiting the capabilities of 5G networks that will ensure the appropriate performance and quality levels in challenging environments, as the one of e-Health, In addition, data management and ingestion, predictive analysis and, in general, ML-based services and tools developed in the context of various use cases being deployed in the scope of 5G-TOURS are expected to increase the functionality of WINGS commercial platforms, particularly with respect to the digital health domain. In the **Remote health monitoring** use case **WINGS** has enhanced its **STARLIT** platform for the continuous, mobile, remote health monitoring of people, especially when already diagnosed with a critical disease still compatible with outpatient care (e.g., some form of cardiovascular disease, hypertension, diabetes, etc.). The overall target is to provide improved, more efficient and accessible remote care and consequently improving the quality of life of affected citizens. The main features offered, utilising the **WINGS STARLIT** platform, include: (a) real time remote health monitoring services of the patients main vital-signs, and (b) quick, reliable notifications to users, family members and health care professionals in case of a health incident or a health emergency prediction.

Towards the above, **WINGS** has already started to pursue valuable synergies with vendors, Telecom Operators and OEMs, so as to set up a collaborative infrastructure that will enable the delivery of the previously described advanced services. For the exploitation of the STARLIT platform there are various ongoing efforts and activities for commercial exploitation aimed at municipalities and stakeholders in the health/wellness domain including a pilot in a care home setting in South of Greece.

3.5 Mobility and transportation ecosystem

The mobility and transportation ecosystem includes two solution providers which develop the sensor deployments that gather information related to mobility and safety as well as other mobility-related systems and applications. It also includes the end-users of such solutions: an airport, a school and a security agency for the safety inside the airport. The detailed exploitation plans are as follows (WINGS, ACTA, Athens International Airport and KEMEA).

WINGS plans to exploit the outcomes of the project, especially the ones related to transportation, towards enhancing the company's software solutions, namely **WINGSPARK**, but also other solutions in different vertical domains, so as to extend the supported set of connectivity options and to be able to offer the platforms services over a wide area connectivity offering, with certain quality guarantees. **WINGSPARK** is a solution for managing land-based transportation infrastructures (roads, rail, etc.) and vehicles, as well as the management of parking infrastructures, via timely predictions and added-value driver services.

WINGS develops digital solutions (software and hardware) and transformations for various vertical sectors, namely solutions for the environment (air quality, natural disasters), **networks and infrastructures** (energy/water/gas, **transportation**, construction), production manufacturing (food, factories/logistics), service sectors (health, education/culture, government, security/defence). Through 5G technologies and the innovation developed in the context of 5G-TOURS, WINGS is enabled in maturing its products and consequently expanding its portfolio and becoming more efficient in its offerings.

For example, it is anticipated that WINGS will be enabled to deliver content and services for, transportation, safety etc. (currently, in the portfolio or new ones), by exploiting the capabilities of 5G networks that will ensure the appropriate performance and quality levels in challenging environments, as the one of safety and transportation. In addition, data management and ingestion, predictive analysis and, in general, ML-based services and tools developed in the context of various use cases being deployed in the scope of 5G-TOURS are expected to increase the functionality of WINGS commercial platforms, particularly with respect to domains such as transportation and safety. In the **Smart airport parking management** use case WINGS aims at extending its WINGSPARK platform to monitor in real-time the parking facility at Athens International Airport by leveraging on its 5G-enabled Smart Parking Occupancy sensors. WINGS also provides a mobile app utilizing 3D graphics, that will assist the users in finding and navigating in the spot leveraging on AI. The smart parking management contributes to the emission reduction by reducing unnecessary driving to locate a parking space. This process

will also add to the travelling efficiency of tourists through targeted parking spot suggestions. This is a solution that relies on the mMTC capabilities provided by 5G.

Towards the above, WINGS has already started to pursue valuable synergies with vendors, Telecom Operators and OEMs, so as to set up a collaborative infrastructure that will enable the delivery of the previously described advanced services. With respect to WINGSPARK platform, WINGS has already deployed a small number of sensors in the Athens International airport. WINGS has also collaborated further with OTE and has achieved the deployment of WINGSPARK cloud platform and its 5G-enabled Smart Parking Occupancy sensors in OTE parking at Psalidi and at Ilissos building, in Athens. Furthermore, WINGS has already achieved the commercial exploitation of the platform via a commercial smart parking project at Central Greece.

With respect to the projects innovations WINGS aims to update and extend the performance diagnosis solution developed in the project by including service profiling and Root Cause Analysis (RCA) capabilities and by applying these capabilities on the trials realised in 5G-TOURS project. Furthermore, WINGS will extend the available orchestration solutions (OSM/MANO) into an AI-enhanced MANO framework providing in addition to efficient resource allocations, service deployment and management of critical services (e.g., prioritisation, fast resource allocation/de-allocation, fast deployment and activation) based on ML algorithms. These solutions and the corresponding know how will be exploited in projects and initiatives beyond 5G-TOURS (such as the new ICT-52 projects Hexa-X, DEDICAT 6G, VITAL-5G, etc.).

ACTA is an integrating, distributing and software-implementing company. As an integrator of software for OTE, the project's solutions are valuable to be exploited through its products. ACTA adapts the outcomes of the project into its products line. Some of the solutions produced in the project will be used to improve ACTA's product offerings and extend the current portfolio of the company.

Athens International Airport (AIA) is particularly interested in addressing the challenge to protect and safeguard the lives and the safety of the tens of thousands of passengers using the airport every day. To cope with potential risks, the Airport needs to have in place those processes and framework that enable their mitigation. The solutions developed within the 5G-TOURS project enable the gathering of the information that will signal the early detection of alarming events raised at the Airport and then fuse and convey this information to the authorities responsible for the decision making. The solutions employed will also allow the responsible authorities to assess the effectiveness and the progress of the execution of these plans. In the case of the parking scenario, the Airport is keen on developing a solution that will enable the airport car parking users to quickly identify a suitable parking place, saving time and energy, reducing emissions and increasing passenger satisfaction. The third use case which comprises of live video feeds from multiple mobile Airport vehicles will result to a dramatic increase of the situational awareness of the stakeholders responsible for the operation of the Airport operation. Upon the execution of the validation tests, AIA will consider and decide upon the integration and use of the solutions developed within the 5G-TOURS project.

KEMEA works very closely with all security stakeholders in Greece to uptake innovative actions, and the expected outcomes from the project are promptly considered by Hellenic Police, Civil protection, Ambulance, Fire and Rescue services for validation and exploitation. KEMEA leverages the project outcomes to improve the existing collaboration between various first responder agencies and minimise the fragmentation experienced when various actors operate in the same incident scene. These synergies with European networks will be used to promote a better level of technology and independence for European strategic autonomy and to support the development of European reference solutions.

3.6 Transversal activities

In addition to the network operators, network equipment providers and the three ecosystems, the 5G-TOURS consortium also includes a number of partners who are playing a more transversal role such as economic analysis of use cases (Real Wireless), introduction of non-commercial solutions into the ecosystems (B-COM, IIT) or innovations from Phase 2 projects (UC3M for 5G-MoNArch and UPV for 5G-Xcast). These are their exploitation plans:

Real Wireless (RW) deepens its business model and economic analysis services capability through analysis of a socio-economic environment in the context of the nodes and identification of drivers and barriers for the adoption of 5G-TOURS concepts in a commercial context. Where appropriate RW's unique in-house developed

tools will be enhanced to enable analytic dimensioning of systems based on wireless data traffic and linked revenues. By application of the RW Techno-Economic assessment framework, which shall be validated and enhanced through 5G-TOURS we will strengthen our ability to rapidly determine the optimal opportunity to assess Total Cost of Ownership of infrastructure and assessment of the business case for investment to enhance our Digital Infrastructure investment advisory services. Systems analysis currently takes into account scope and scale across spectrum, compute, storage and networking resources. RW develops a refined vertical driven use case analysis approach, establishing key stakeholders, service value chain positioning and critical functional and techno-economic performance KPIs within the architecture framework. We shall also increase our technology value assessment of AI and Automation based approaches. This shall enable a Connected City practice which utilises our synthesis and analysis tools to accelerate investment and business case evaluation and decision making. RW develops a new business model broker service concept designed to accelerate adoption of innovations in vertical industries.

B-COM contributes to the project both with its telecommunications and its health departments. As to results obtained on the telecom infrastructure, B-COM promotes VNFs that are rolled out as part of 5G-TOURS' Rennes node, which include both open-source building blocks and B-COM ingredients. B-COM is particularly cautious with open-source licenses to prevent hurdles in licensing these VNFs within the scope of 5G-TOURS but also to industries outside the consortium in the private network solutions sector. Additionally, B-COM has already built a marketing plan for a testbed service built on top of a 5G end-to-end facility. B-COM is willing to enhance this service offering with the results of 5G-TOURS project, in particular 5G connectivity in millimetre spectrum. Finally, B-COM is building ingredients to support real-time medical video over IP, based on the upcoming standard DICOM-RTV, as well as software components enabling easier development of medical AR applications. B-COM is willing to enhance these ingredients to support 5G, including wireless communications.

IIT is currently collaborating with various companies and end-users to develop service applications on its R1 robot and is investigating potential economic exploitation of these technologies for retail, surveillance and healthcare. Such results are to a large extent a public asset, which can be applied for society's use and benefit. IIT has created a network of companies that has resulted in more than 400 sponsored research agreements, a portfolio of more than 570 filed patents, 12 joint laboratories with national and international companies and research institutions, and 17 start-up companies. IIT plans to leverage 5G-TOURS in order to build more powerful robots that rely on 5G for remote control and to provide telepresence servers. The ultimate aim is to transfer the prototypes developed within 5G-TOURS to the productive sector, either by means of a start-up or leveraging the IIT network of industrial collaborations.

UC3M is using the results of the 5G-TOURS project along three lines. First, to strengthen the academic leadership: the leading role of UC3M in this area has been recognised by the research community, and the participation of UC3M in the 5G-TOURS allows to publish research results in top-rated conferences and journals, which helps to further strengthen UC3M's position and increase its visibility as one of the top academic institutions active in the field of 5G. In particular, UC3M has already published some of the results in top venues such as ACM MOBICOM, IEEE INFOCOM, IEEE JSAC, and IEEE Transactions on Mobile Computing, among others. Second, to foster the technology transfers to enterprises: technology transfer to enterprises is one of the key activities of UC3M. This is being achieved through the standardisation and patents, among. During 5G-TOURS execution, UC3M researchers have licensed a patent application on technologies related to the project and have actively contributed to ETSI ENI standardisation. Third, to consolidate the academic courses portfolio: according to several national rankings, UC3M is classified among the top universities in Spain for computer science and telecommunication network studies. The knowledge achieved from the participation in 5G-TOURS provides innovative content to the courses being taught. In particular, UC3M is teaching two master's degrees closely related to 5G-TOURS which are being fed with the knowledge gained from the project: the Big Data MSc and the 5G MSc. UC3M researchers have also taught 5G topics in master degrees from other European Universities.

UPV has an important role in 5G-TOURS by (i) expanding the knowledge, teaching and training future engineers working in the fields of telecommunications, and (ii) contributing to standardization and dissemination activities, publishing research in scientific venues such as journals, magazines and major international conferences.
UPV is currently exploiting not only the project results but also the experience gained in further expanding its

knowledge in the 5G field. UPV also enhances its teaching scope and quality by introducing new project findings and cutting-edge technologies into the teaching and research syllabus at undergraduate, postgraduate teaching and research. UPV focuses on the design and performance evaluation of 5G Broadcast and the correct integration in the use cases considered within the project for trials and demonstrations in Turin.

In particular, UPV will closely collaborate with RAI and other partners in the demonstration of multicast FeMBMS transmissions and work on the development of an enTV Rel-16 receiver to carry out High-Power High-Tower broadcast trials. They will additionally integrate some of the multicast/broadcast results of the phase-2 5G-Xcast project, where UPV was coordinator, in the 5G core and provide their expertise in digital broadcast standardization (e.g. DVB-T2, DVB-NGH, ATSC 3.0).

3.7 Exploitation Tables

This section consists of five tables summarising exploitation features related to the ecosystems defined in the project: Network operators & network equipment providers, the three vertical ecosystems, corresponding to the three trials (Media and entertainment, Healthcare and safety, Mobility and transportation), and a final one covering transversal activities. Every table includes collections of inputs provided by every partner involved in every ecosystem, for an easy reading.

Data collected by partners relate to the project activity developed until now. There is no variation respect the first phase (same tables as in D8.1) as the activities are still running in the foreseen way without any particular deviation or update.

Stimulating indications are emerging from the data collected by partners: all the sectors of application of project partners are involved in a time-frame already starting from the first year of project towards its end and, for some areas, continuing also after the project will be completed.

The most relevant outcomes are highlighted below:

- Network operators & network equipment providers:
    - Specific knowledge about specific use cases is remarkable for improving and adding functionalities to already available solutions to adapt to the specific needs of verticals;
    - Performance characterization (e.g. throughput, latency) of different use cases;
    - Collection of "from-the-field" requirements for Network Slice applications;
    - Relevant feedback in standardisation activities
- Media and entertainment:
    - Improving research on educational innovation and innovative educational practice;
    - Content distribution for Broadcasters and Media Companies;
    - Innovative educational practice based on 5G functionality offer for enhanced teaching and learning both at school and outside the classroom;
- Healthcare and safety:
    - Tele-guided diagnosis and connected care solutions in case of emergency care, hospital and ambulance;
    - Patient monitoring and low-cost solutions;
    - Validation of the synchronization of live sources of image data for AR;
- Mobility and transportation:
    - Smart & digitized Airport services in the Airport management sector;
    - New Products and / or Assisted living and smart cities services;
    - Use of Data analytics services and tools to evaluate the effectiveness of the use cases and identify areas of improvement;
- Transversal activities:
    - Application of trials data to the enhancement and validation of the techno-economic models;
    - Increased awareness of AI and AI algorithms that leverage data analytics;
    - Investment opportunity assessment framework.

3.7.1 Network operators & network equipment providers

The following Table summarizes exploitation features related to the ecosystems defined in the project for the Network operators & network equipment providers' segment.

Table 1. Network operators & network equipment providers exploitation table.

Description of exploitable result / knowledge	Exploitable product(s) or measure(s) in which the result / knowledge will be used	Sector(s) of application	Time-plan for use	Deliverable(s) to which 5G-TOURS deliverables / results does the topic relate to	Owner and other beneficiaries involved
Improved knowledge on Use Case definition	Define Use Case associated requirements on 5G Mobile System CPNF(s) and 5G-RAN For Use Case 2 and 3, specific knowledge on Docker application, Video compression management and Packet Management For UC10-13, specific knowledge on user and network requirements and network infrastructure Cat-M and / or NB-IoT product. The improved knowledge on use case will help us to improve and add functionalities to our catM / Nb-IoT solutions, to adapt to the specific need of verticals Research activities on Smart Tourism use case Build understanding on use case that will be used to improve Phone's support of these use cases. Improve the AR/VR experience Improved understanding of verticals	Vendors and Operators: • R&D Development Environment and Telco Labs • Network Management • Other 5G projects • New products or/and Services to offer towards end users • Chipset and module providers • Mobile Vendors increase phone's support for use cases • AR/VR vendors and application creators	Now and throughout the lifecycle of the project For Chipset and module at the end of the project Starting with integration of WP5 testbed in Rennes approx. September 2020 through to end of project and beyond	D2.x D4.x (Turin trial) D5.x (Rennes trial) D6.x (Athens trial) D5.x (Rennes trial) Direct and indirect Scientific publications in conferences	all stakeholders for use cases where they are involved in WP4, WP5 and WP6: • mobile network operators • mobile network equipment providers WP5 participants and related partners from WP3 on network side and WP7 on testing

	use case requirements will aid in testbed implementation and feed future work on local network projects including contributions to 5G-EVE Specific spectrum requirements dictate certain equipment, the use and integration of which will aid in future developments	Primarily the health sector with specific focus on the use cases around AR/VR, remote triage and improving the efficiency of delivery of care in a Smart City environment; other 5G projects and research on OpenRAN to support use cases			
Knowledge on 5G mobile network architecture	Specific knowledge on antennas, BBUs, and network infrastructure Study of Broadcast application of 5G Network Deep study of Outdoor/Indoor 5G coverage for specific historical areas Performance characterization in term of throughput, latency of different use cases especially in the communication user/server Server positioning for data elaboration needed to implement the use case. UE positioning for 5G Networks Define Use Case associated requirements on 5G Mobile System CPNF(s) and 5G-RAN Build new architecture compliant mobile phones OSM / RFQ / RFI	OTE Labs, other 5G projects and Greek site of the 5G-EVE Sharing of practical Use Case experiences within Ericsson/ within Nokia Experience can be applied in R&D development and E2E System Verification Mobile Vendors and Operators Vendors and Operators	Now and throughout the lifecycle of the project First half of second year of the project Starting with planning of WP5 testbed in Rennes Q2 through to end of project and beyond	D3.1 D6.x D7.x D3.x D4.x D7.x D3.x D6.x D7.x D3.x D5.x Internal reports and scientific dissemination	OTE NOKIA GR WP4 involved partners WP6 involved partners Operators and Equipment Providers ATOS WP5 participants and related partners from WP3 on network side and WP7 on testing

	Integration work with specific network equipment from multiple vendors. Work on Open Source implementations to support use case requirements. Network coverage planning to support use case locations. Modelling bandwidth expectations against specifications of networking equipment	Rennes testbed based on 5G-EVE extended from Paris Saclay Sharing of use case experiences between network vendors and use case verticals on testbed implementation side Feeding back outcomes to R&D based in Rennes supporting the 5G-EVE networks			
Knowledge on 5G network slicing	Dynamic Slice allocation and Network Slice characterization in terms of associated KPI values to manage and fulfil the requirements of different Use Cases Specific knowledge on antennas, BBUs, and network infrastructure Orchestration definition in Turin use cases implementation OSM / RFQ / RFI Proposing the use of standardised industry methods as described in GSMA Network Slicing Taskforce (NEST) to collate all use case slicing requirements Study of availability of slicing technology as applicable to the project based on	Requirement collection for real applications Feedback to R&D OTE Labs, other 5G projects and Greek site of the 5G-EVE Vendors and Operators Ensuring all use case requirements are collected in a manner that allows for orchestration and slicing design to be handled efficiently Sharing with R&D on Open Source	Requirement collection as for now; Implementation last year of the project Now and throughout the lifecycle of the project 1st half of the project First half of second year of the project Starting in Q2 through to end of project	D3.x D7.x D3.1 D6.x D7.x D4.x D5.x	NOKIA GR OTE ERI-IT TIM OTE NOKIA GR TIM ATOS ORANGE NOKIA FR B-COM

		side and dele-gate to GSMA Nest			
Knowledge on orchestration in 5G mobile networks	Dynamic Slice allocation and to manage different use case requirements, UC10-13

Application of theoretical requirement to the real use-cases: expected tuning of current products based on real use case application results

Automate deployment and service assurance by performing automated healing and scaling

OSM / RFQ / RFI

Gaining insight to the level of granularity required in slicing to support multiple simultaneous use case requirements

Use of ONAP in the context of 5G use cases over multi-region IaaS deployments with Openstack and Kubernetes | Feedback to Greek Site orchestration development in 5G EVE

Feedback to Ericsson orchestration development in 5G EVE

NOKIA Service automation and dynamic Orchestration solution Feedback to NOKIA orchestration development in 5G EVE

Vendors and Operators

Iterative process with R&D on sharing the orchestration design and implementation results | Last year of the project

First half of second year of the project

Starting after successful integration of WP5 testbed in Rennes to end of project | D3.x

D5.x | OTE

ERI

NOKIA GR

ORANGE NOKIA FR B-COM |
| **Knowledge on data analytics in 5G mobile networks** | OTE's KPIs Measurements and Validation

Build experience from the relevant use case on data analytics

Defining the metrics and test practices to meet requirements from WP7; developing better under- | OTE labs 5G TOURS results to be monitored and identify opportunities

Operators/infrastructure providers

Rennes Testbed and partners

Sharing results and | Now and throughout the lifecycle of the project | D6.x   D7.x

D3.x

D5.x | OTE

Operators and Equipment Providers

ORANGE NOKIA FR B-COM |

	standing of key metrics on a multi vertical use case network	learnings with R&D			
Knowledge and industry insights on the business drivers for and wider socio-economic value of 5G networks	5G TOURS feedback to OTE/Ericsson/TIM/NOKIA Product & Strategy Management Build Knowledge on market trends in terms of adopting 5G for various use cases Dissemination of project results to Orange SA departments focusing on healthcare verticals	New Products or/and Services to offer towards end users Vertical providers, operators Developing better 5G related offers to relevant verticals partners	Now and throughout the lifecycle of the project	D8.3 D5.x	OTE ERI IT TIM NOKIA GR Verticals and operators WP5 partners
Experience on the implementation of network slicing in a testbed	OSM / RFQ / RFI Learning from the actual implementation of slicing templates to evaluation of practicality, meeting of KPI and validation of efficiencies brought about	Vendors and Operators Refining of slicing definition and impact on orchestration methodology based on results from testbed	First half of second year of the project	D5.x	ATOS ORANGE NOKIA FR B-COM
Standardisation impact	Relations of the performed activities in the Turin testbed towards the definition of the Release 16 3GPP specs Technical activity undergone in the project helped us to promote enhancements to cat-M and NB-IoT into 3GPP Results from slicing and orchestration implementation feedback via delegates to 3GPP and OpenRAN, and others where applicable 5G TOURS feedback to stake-	Vendors, operators and wherever the standardisation is implemented/used, including MNO and vertical partners	Now and throughout the lifecycle of the project	D8.1 D8.2 D8.4 D5.x	Project stakeholders and 5G Eco System All partners, especially those that are members of 3GPP

	holder's representatives in standardisation committees Improve the standard quality from the research and test bed results feedback				
IPR for standardisation essential topics	5G TOURS feedback to stakeholder's representatives in standardisation committees	Vendors, operators and wherever the standardisation is implemented/used, including MNO and vertical partners	Now and throughout the lifecycle of the project	D8.1 D8.2 D8.4 D5.x	Project stakeholders and 5G Eco System

3.7.2 Media and entertainment ecosystem

The following table summarizes exploitation features related to the ecosystems defined in the project for the Media and entertainment segment.

Table 2. Media and entertainment exploitation table.

Description of exploitable result / knowledge	Exploitable product(s) or measure(s) in which the result / knowledge will be used	Sector(s) of application	Time-plan for use	Deliverable(s) to which 5G-TOURS deliverables / results does the topic relate to	Owner and other beneficiaries involved
Improved knowledge on Use Case definition	Research on educational innovation and innovative educational practice leveraging the potential offered by 5G for enhanced teaching and learning at school and outside the classroom Content distribution, enriching television experience and remote television production Media contents enriching touristic and cultural experiences (e.g.	Education and educational innovation, including education-related research and development, educational services, educational content, teacher training Broadcasters and Media Companies	During the project as well as after the end End of project	D2.1, D6.1, D6.2, D6.3 D2.x D4.x (Turin Trials)	EA RAI, LIVU, FTM, TOR

	promotional video)				
Knowledge on 5G mobile network architecture	Research and service development	Broadcasters and Media Companies	End of project	D3.x D4.x	RAI, LIVU, TIM, ERI
Knowledge on 5G network slicing	Improving the remote television production work flow	Broadcasters and Media Companies	One year after end of project	D3.x D4.x	RAI, LIVU, TIM, ERI
Knowledge on orchestration in 5G mobile networks	Research and knowhow	Broadcasters and Media Companies	End of project	D3.x	RAI
Knowledge on data analytics in 5G mobile networks	Content distribution, and enriching television experience	Broadcasters and Media Companies	One year after end of project	D4.x	RAI, TOR, FTM
Knowledge and industry insights on the business drivers for and wider socio-economic value of 5G networks	Research on educational innovation and innovative educational practice leveraging the potential offered by 5G for enhanced teaching and learning at school and outside the classroom Content distribution, enriching television experience and remote television production	Education and educational innovation, including education-related research and development, educational services, educational content, teacher training Broadcasters and Media Companies	Continually during the 5G-TOURS project as well as after the funded project period End of project	D2.1, D6.1, D6.2, D6.3 D4.x D8.x (Turin trials)	EA RAI, All
Experience on the implementation of network slicing in a testbed	Content distribution, enriching television experience and remote television production	Broadcasters and Media Companies	End of project	D4.x (Turin trials)	RAI, LIVU, FTM, TOR, TIM, ERI
Standardisation impact	Content distribution, in particular	Broadcasters and Media Companies	One year after end of project	D4.x D7.x D8.x	RAI, TIM, ERI

	Broadcast TV services (it depends also on standard implementation on devices)				

3.7.3 Healthcare and safety ecosystem

The following Table summarizes exploitation features related to the ecosystems defined in the project for the Healthcare and safety segment.

Table 3. Healthcare and safety exploitation table.

Description of exploitable result / knowledge	Exploitable product(s) or measure(s) in which the result / knowledge will be used	Sector(s) of application	Time-plan for use	Deliverable(s) to which 5G-TOURS deliverables / results does the topic relate to	Owner and other beneficiaries involved
Improved knowledge on Use Case definition	Tele-guided diagnosis and intervention solutions for emergency cases	Emergency care, hospital and ambulance.	End of project	D2.X D3.X D5.X	CHU, PRE, PFC, AMA, ORA, B-COM, NOKIA
Knowledge on 5G mobile network architecture	Improved connected care solutions, in particular Ultra Mobile Ultrasound	Emergency care, hospital and ambulance Patient monitoring. Interventional healthcare applications	End of project	D2.X D3.X D5.X	CHU, PRE, PFC, AMA, ORA, B-COM, NOKIA
Knowledge on 5G network slicing	Improved connected care solutions	Emergency care, hospital and ambulance. Patient monitoring. Interventional healthcare applications	End of project	D2.X D3.X D5.X	CHU, PRE, PFC, AMA, ORA, B-COM, NOKIA
Knowledge on orchestration in 5G mobile networks	Low-cost multi data type and real time streaming connected care applications: network-based orchestration iso applica-	Emergency care, hospital and ambulance. Patient monitoring. Interventional healthcare applications	End of project	D2.X D3.X D5.X	CHU, PRE, PFC, AMA, ORA, B-COM, NOKIA

	tion level orchestration of data streams				
Knowledge on data analytics in 5G mobile networks	Medical grade audit trails to proof SLA and medical claims wrt reliability and latency	Emergency care, hospital and ambulance. Patient monitoring. Interventional healthcare applications	End of project	D2.X D3.X D5.X	CHU, PRE, PFC, AMA, ORA, B-COM, NOKIA
Knowledge and industry insights on the business drivers for and wider socio-economic value of 5G networks	Healthcare of the future: small hospitals, diagnosing and treating patients at home	Healthcare as a whole	End of project	D2.X D3.X D5.X	CHU, PRE, PFC, AMA, ORA, B-COM, NOKIA
Experience on the implementation of network slicing in a testbed	validation of the prioritization of information flows (sound, ultrasound, video, ...) for tele-assistance (health emergencies)	health emergency services	applicable at the end of project	D5.x (Rennes Trials)	CHU, PRE, PFC, AMA, ORA, B-COM, NOKIA
Standardisation impact	Critical medical care				
OTHER: experience on the implementation of network latency and reliability and of data rate in a testbed	validation of the synchronization of live sources of image data (ultrasound, fluoroscopy, video, …) for AR (operating room)	health emergency services	applicable at the end of project	D5.x (Rennes Trials)	CHU, B-COM, AMA, ORA

3.7.4 Mobility and transportation ecosystem

The following Table summarizes exploitation features related to the ecosystems defined in the project for the Mobility and transportation segment.

Table 4. Mobility and transportation exploitation table.

Description of exploitable result / knowledge	Exploitable product(s) or measure(s) in which the result / knowledge will be used	Sector(s) of application	Time-plan for use	Deliverable(s) to which 5G-TOURS deliverables / results does the topic relate to	Owner and other beneficiaries involved
Improved knowledge on Use Case definition	e-Health, safety and transportation Products development Situational awareness, safety and transportation Products and services development	Assisted living and smart cities services Smart & digitized Airport services in the Airport management sector in terms of Aircraft operations and safety management	During the project lifecycle and beyond in future research initiatives and Airport operational management initiatives	D2.X, D5.X and D6.X	WINGS AIA
Knowledge on 5G mobile network architecture	Smart Parking and Health Products development Required 5g network architecture and infrastructure deployment at Airport premises	Assisted living and smart cities services Smart & digitized Airport services in the Airport management sector in terms of Aircraft operations and safety management	During the project lifecycle and beyond, in future research initiatives and in future investments of the airport regarding 5G implementation	D2.X, D3,X, D5.X and D6.X	WINGS AIA
Knowledge on 5G network slicing	Network Slice characterization in terms of associated KPI values to manage and fulfil the requirements of Use Cases 6, 9 and 10. WINGS KPIs Measurements and Diagnostics tool	WINGS R&D activities Slicing for Airport management in terms of simultane-	During the project lifecycle and beyond in future research initiatives and in future investments of the airport regard-	D3.X, D7.x	WINGS AIA

	Identifications of Network Slice requirements in order to fulfil the requirements of use Cases 10,11 and 12.	ous, transmission of high-speed mobile, high definition video & building evacuation operations & safety management	ing 5G implementation		
Knowledge on orchestration in 5G mobile networks	Dynamic Slice allocation to manage different use case requirements	Feedback to Greek Site orchestration development in 5G EVE Knowledge on 5G mobile network orchestration in terms of simultaneous, transmission of high-speed mobile, high definition video & building evacuation operations & safety management	During the project lifecycle and beyond in future research initiatives and in future investments of the airport regarding 5G implementation	D3.X, D6.x, D7.x	WINGS AIA
Knowledge on data analytics in 5G mobile networks	Data management and ingestion, predictive analysis and, in general, ML-based services and tools developed in the context of various use cases being deployed in the Athens and Rennes. WINGS KPIs Measurements and Diagnostics tool Use of Data analytics services and tools in order to evaluate the effectiveness of the use cases and identify areas of improvement	Assisted living and smart cities services Use of Data analytics services and tools in order to evaluate the effectiveness of simultaneous, transmission of high-speed mobile, high definition video & building evacuation operations & safety management Telecom	During the project lifecycle and beyond in future research initiatives End of project	D3.X, D7.X D6.3 D7.3	WINGS AIA ACTA

	ACTA's KPI Validation Platform (KVaP)				
Knowledge and industry insights on the business drivers for and wider socio-economic value of 5G networks	5G-TOURS feedback to WINGS commercial department for monitoring diagnosing and treating patients at home as well as smart parking management Efficient and effective Airport apron monitoring, coordination between Airport stakeholders control centres	New Products and / or Assisted living and smart cities services to offer towards end users New Products and services for the sectors of simultaneous, transmission of high-speed mobile, high definition video & building evacuation operations & safety management	During the project lifecycle and beyond, in future research initiatives and in future investments of the airport regarding 5G implementation	D2.X, D5.X, D6.X, D8.3	WINGS AIA

3.7.5 Transversal activities

The following Table summarizes exploitation features related to Transversal activities defined in the project.

Table 5. Transversal activities exploitation table.

Description of exploitable result / knowledge	Exploitable product(s) or measure(s) in which the result / knowledge will be used	Sector(s) of application	Time-plan for use	Deliverable(s) to which 5G-TOURS deliverables / results does the topic relate to	Owner and other beneficiaries involved
Improved knowledge on Use Case definition	For UC4, UPV will obtain knowledge in broadcast applications to mobile networks New research directions, novel potential applications	R&D, vendors, operators, broadcasters Research, service robotics	Now and future 3GPP releases Expecting a better understanding of the difficulties in the use case after start-	D2.x D4.x D4.2, D4.3	TIM, RAI, EXP, ERI IIT, TOR, ERI-IT

	Further enhancements to the RW extensive database of 5G use cases and KPIs	All verticals infrastructure investment types	ing experiment in the field, therefore exploitation of such knowledge may start towards the end of the project End of the project	D8.3 D2.3	
Knowledge on 5G mobile network architecture	5GC multicast product development, IPR development	R&D, vendors, operators, Broadcasters	By the end of the project	D3.x D4.x D7.x	TIM, EXP, ERI
	Increased knowledge on 5G mobile networking in general may help us improve middleware software for robotics	Research, service robotics	Knowledge on 5G mobile networking will be gained after initial tests with 5G networks (Jan 2021)	D4.2	IIT, ERI-IT
	Integration of 5G-NR RAN pre-commercial equipment with BCOM Core network	Private networks, PoC	Along the project	D3.x D5.x (Rennes trials)	BCOM, WP3/WP5 Stakeholders BCOM sponsors
	Knowledge on Data Plane deployment at the EDGE to achieve low latency communications			D8.3 D2.3	
	Investment opportunity assessment framework	All verticals infrastructure investment types	End of the project		
Knowledge on 5G network slicing	Slicing Manager to assign high priority to critical user data traffic	Private networks, PoC	Along the project	D3.x D5.x (Rennes trials)	BCOM, WP3/WP5 Stakeholders BCOM sponsors

	Dimensioning of slices for allocation of resource for CAPisce tooling Algorithm for allocation of resources for network slicing	All verticals infrastructure investment types Equipment manufacturing	End of the project Future standard releases	D8.3 D2.3 D3.1	 UC3M
Knowledge on orchestration in 5G mobile networks	Orchestration through 5G EVE platform Linked to dimensioning of slices but depends on nature of slices Algorithm for orchestration of resources based on AI	All verticals infrastructure investment types Equipment manufacturing	Along the project Future standard releases	 D3.1	WP3/WP5 Stakeholders BCOM sponsors UC3M
Knowledge on data analytics in 5G mobile networks	Increased awareness of AI and automation-based implications and value propositions AI algorithms that leverage data analytics	All verticals infrastructure investment types Equipment manufacturing	End of the project Future standard releases	D3.1	UC3M
Knowledge and industry insights on the business drivers for and wider socio-economic value of 5G networks	Enhancements to the RW techno-economic value creation and capture assessment framework are anticipated	All verticals infrastructure investment types	End of the project	D8.3 D2.3	
Experience on the implementation of network slicing in a testbed	Prioritization for the data flows through the service layer	b<>com experimental plat-	Along the project	D3.x D5.x (Rennes trials)	WP3/WP5 Stakeholders

		form and associated service offering			
	Application of trials data to the enhancement and validation of the techno-economic models	All verticals infrastructure investment types	End of the project	D7.3	
Standardisation impact	Broadcast and multicast SI/WIs in 3GPP	Vendors, operators, Broadcasters	Now and future 3GPP releases	D4.x D7.x D8.x	TIM, RAI, EXP, ERI
	Use of DICOM-RTV in a real Operating Room setup and to show benefits of such standard	E-Health and Operating Room equipment and integration	Along the project	D5.x (Rennes trials)	CHU
	Feedback from physicians/surgeons on real life communication requirements for medical use cases allowing to refine 3GPP specifications	TR 22.826 TS 22.104 TS 22.261 TS 22.263			
		Equipment manufacturers& network operators	Future standard releases	D3.1	UC3M
	Framework for data analytics based on ENI standard				
OTHER	Improve the ingredient "DICOM-RTV Converter" software	e-Health	Along the project		BCOM, CHU

3.7.6 Products/Service innovation

The following table contains short description of innovations developed in the project. Six innovations, that are already mature, are described while other innovations are still in development phase and will be described in future versions of report on innovation.

The innovations described are all related to services relating to the different vertical areas. The first three innovations were included in the DG connect questionnaire.

Table 6. Product/Service Innovation.

#	Partners involved	Title of invention	Description

| 1 | AMA Philips | Tele guidance for diagnostics and intervention support through 5G mobile transmission of real time ultrasound images, video and audio streaming and smart glasses use. | The innovation advances the communication between caregivers in the ambulance / near the patient, the remote coordinator expert (medical regulator at the hospital), remote consulting experts and emergency department staff to improve the survival and treatment of patients. This should improve the outcome for and wellbeing of patients on the short and longer term, reduce the workload and stress of all care providers while improving their effectiveness, and last but not least, reduce the overall cost of care on the short and longer term so that patients can participate fully in society again after a quick recovery.

The innovation is built on streaming live video, live ultrasound images, in addition to voice communication, leveraging the capability of new WebRTC services and 5G cellular networks to give high-quality video and reliable medical feeds to the emergency care regulators for best decision making.

By making use of advanced smart-glasses, the ambulance doctor is able to view both video and ultrasound of the patient and can transmit to both a remote regulator and consulting experts.

A remote expert and regulator will be able to see the patient (video), look inside the patient (ultrasound) and support all kinds of diagnosis and treatment procedures by providing verbal and visual instructions on how to hold the ultrasound probe for best diagnostic precision and can show (through video overlay) the ultrasound probe on the patient's body.

The glasses' display offers the ambulance doctor / paramedic hands-free access to relevant information (such as live ultrasound images, video, ECG, etc.). |
2	Ericsson Istituto Italiano di Tecnologia	Autonomous 5G operated robotic system for telepresence and museum guide	The innovation consists in an upper-body humanoid robot equipped with wheels. The robot can be deployed in a museum to allow users to visit the museum from a remote location or museum personnel to inspect the museum for surveillance. In addition, the robot can operate autonomously to guide visitors inside the museum. The robot can navigate autonomously thanks to the wireless connection that uses 5G technology to guarantee necessary performance in terms of latency, bandwidth and reliability.
3	AIA OTE WINGS	Large scale IoT deployment using 5G mobile Networks standards for identifying car park availability and driver guidance in large car parking environments.	This innovation makes use of the mMTC (massive Machine Type Communications) and NB-IoT (Narrow Band – Internet of Things) to install thousands of proximity sensors at every car park position of massive car parks such as those at Airports, Stadiums, shopping centres etc. these sensors will indicate which parking spot is occupied and which is not, transmit its status over 5G network and present it at a mobile platform. In this way drivers can identify and be guided to empty car park spaces in an efficient and environmentally friendly manner
4	AIA OTE WINGS	Multiple Ultra High Definition Video feed transmission from 5G based enabled ground moving vehicles	This innovation makes use of the transmission speeds and bandwidth capacity of the 5G mobile network to broadcast Ultra High definition video feeds from ground-based vehicles equipped with 4K pixel resolution video cameras. The vehicles are part of the follow-me ones that operate within the airport apron and attend critical events and accidents at the respective area. The feeds will be

			aggregated to a media streaming server and transmitted to the operational centres of the airport and airport stakeholders such as police, firefighting services, civil protection etc. with the aim to achieve a common situational awareness. This will assist the decision-making process and the coordination of the first responders in case of an incident.
5	AIA Nokia WINGS	5G based indoor navigation technology for passenger guidance using 5G enabled devices	This innovation makes use of the 5G features for enabling the identification of the location of passengers and how they progress with their journey - in a massive scale - in large and complex structures such as an airport terminal. The 5G Mobile features will be complimented with specific software that will map the floorplans of the building structure and will provide specific features such as journey characteristics such as origin and destination, way finding and navigation instructions to the passengers. Large building structures such as airport terminals are complex structures with multiple floors and large number of rooms where thousands of passengers are using them at any given time. In this context this innovation is addressing both passenger experience aspects through the efficient and effortless navigation of passengers within the airport terminal but also passenger safety aspects during an emergency evacuation.
6	BCOM	A Novel 2D Ultrasound Probe Calibration Framework using an RGB-D Camera and a 3D-Printed Marker	The innovation consists in a simple and low-cost augmented reality echography framework using a standard RGB-D Camera and a specifically-designed 3D marker. We believe that with the potential democratization of RGB-D cameras integrated in mobile devices and AR glasses in the future, our prototype solution may facilitate the use of 3D freehand ultrasound in clinical routine.

4 Innovation

Section 4 has no variation respect the first phase of the project as the activities are still running in the foreseen way without any particular deviation or update.

5G-TOURS follows the 4Ps of innovation (Product, Position, Process, Paradigm) focused on Product/Service and Position in the market. In the following, sector per sector, it is described the improvements that can be provided thanks to the introduction of 5G, in particular related to Products/Services commercial impact.

Contributions to the standard, identification of partners business opportunities and IPR are the main outcomes of project's key touchpoints and processes.

Please refer to section 4. of deliverable D8.1 for complete text.

4.1 Touristic Sector

4.1.1 Product/service Characteristics

Tourism is one of the sectors more seriously affected by the pandemic, with restrictions both to travel and to the ability to do any relevant activity at the destination, due to the restrictions put in place in most countries, such as quarantine, closures, and other public health measures and safety precautions.

This disruptive event put the touristic industry in front of the necessity to rethink tourism according to new paradigms, so to re-emerge from this period in a better shape, suitable to cope also with other essential objectives that require a change, in particular the aspects of sustainability and inclusiveness, with the consciousness that the future recovery can only pass from the use of digital technologies to allow the management of both services and the relationship with tourists in a different and innovative way.

In particular, two concepts are taking place to evolve Smart Tourism: Slow and Never-ending Tourism, both expression of a drastic change from the pre-pandemia "hit-and-run" tourism, to match the interest of people to travel with the need of sustainability.

Slow Tourism means responsible and sustainable tourism, allowing preserving natural and cultural resources. It safeguards and promotes the growth of territories, even those which are poorly known, and makes them valuable tourism destinations. It is strictly related to the concept of slow mobility and the research of new itineraries, for visitors to experience new, different emotions passing through natural landscapes, to live and "taste" them while at the same time promoting their protection as patrimonies of inestimable worth, as a richness to be safeguarded for our common wellbeing. Already in 2016, Italian MiBACT's Minister created an atlas of paths, which includes a wide network of paths passing through the whole country. It is a great way to identify all the existing paths, all the interconnections among them and all the possibilities and ways to travel them. At the same time is allows to value their cultural and natural heritage (https://ecobnb.com/blog/2017/12/paths-italy-atlas/).

Never-ending Tourism comes as a specific proposal to respond to the Covid-19 pandemia, to allow travelers to extend their visit also before and after the visit itself, transforming the simple touristic experience into a more complex one, creating a strong link between the tourist and his destination. This creates new commercial possibilities for the tourism sector and for the whole territory on which it rests. The extension of the tourist experience, at the basis of the Never-ending Tourism concept, cannot be separated from a digital implementation, going to foresee a new tourist offer made up of contents and services to be distributed through digital channels to anticipate in the pre-trip and continue in the post-trip relationship with the customer and generate additional sources of income. Never-ending Tourism builds on the concept that the future of tourism cannot be separated from digital innovation that involves all of our lives. And it is through digital innovation that the physical touristic experience can be integrated/augmented or even replaced by virtual experiences, removing barriers and reducing environmental impact, for a sustainable world.

4.1.2 Market position and innovation potential

Innovation is the Engine of the Transformation of Tourism into Smart Tourism: the "Touristic city node" built by 5G-TOURS in the city of Turin creates a framework where products and services are created, targeting the 5 A's of Tourism, i.e.:

1. Attraction: It includes all those factors which attract a tourist. It could be a place, nature, lakes, beach, monuments etc.

2. Accessibility: It is how to access or reach to that place of attraction. Ways to reach.

3. Accommodation: Place to stay or accommodate while travelling for rest or overnight stays.

4. Amenities: All the other services which we require while travelling for good and comfortable living while travel such as food, drinking water, sanitary, etc.

5. Activities: It includes activities which a place or attraction holds such as nature walks, history & architecture, boating, views, health, etc., empowered by the use of the most advanced technology.

The Touristic City of 5G-TOURS is a place where visitors are provided with 5G-based applications to enhance their experience:

- Virtual Reality (VR)/ Augmented Reality (AR) for immersivity.

- Gamification to involve the youngest and promote connections and social inclusiveness.

- Robot-assisted services to improve employees work/life balance and productivity.

- Telepresence to allow for remote visits.

- Media distribution and production to further improve the visitors' experience with additional content.

The 5G-TOURS innovations allows the development of services and products to cope with the Covid-19 emergency, offering services to tourists on site and to local residents that guarantee a safe experience. Social distancing could be provided by the use of robot-assisted visits, that control the number of visitors at a touristic site or in front of an attraction. Use of personal devices instead of those rented by the museum for guided 5G-TOURS could be another means for reducing social distancing issues.

The 5G-TOURS innovations, however, also represent important tools to accompany the Touristic sector in its evolution, the post Covid-19 era: the immersivity experience offered by VR/AR can allow the creation of a new virtual tourism opportunity, to improve, complement or even replace the physical tourism experience. The 5G-TOURS use cases represent examples of products and services for these new types of tourism.

4.1.3 Business opportunities

During the last decade, museums all over the world witnessed a decrease in visitors. Augmented reality can help in reversing this trend, acting as a flying and motivating even the youngest users/visitors to visit a museum through technologies they are familiar with. The same for the gamification experience, which in addition to involving the youngest in the discovery and comprehension of an artist and museum, generates an educational and social benefit by promoting connections and social inclusive-ness. The fruition can be on site, during the visit itself, but could also be made available after (or before, in preparation of) the visit. Or even represent elements of a virtual visit or telepresence.

High quality video service distribution and remote and distributed video production allow the users, through the use of smartphones, tablets, AR devices and monitors to receive educational and informative content during their visits to the city and its museums. One expected result has to be considered in terms of education. A specific professional 4K-HDR video will be produced for both testing and promotional activities about the city and its culture. The expected return in this sense is more related to the use of innovation technology to improve the strategy market for the touristic promotion.

Extending to a less conventional point of view, VR/AR products could also represent an added value opportunity for Media companies, both for their live channels and their OTT platforms: the VR/AR product could represent a specific content for a Travel documentary, to be consumed on demand, either independent, present in the

internet platform of the media company, or linked to a linear program. The TV program describes the travel opportunity, and the VR visit of a remote location is offered to the audience.

There are several socio-economic drivers for Telepresence: reduction of travel spend, reduction of carbon footprint and environmental impact, improve employee's work/life balance and productivity (e.g. Surveillance of the museum(s)). Telepresence favors, among others, the inclusiveness and accessibility of disadvantaged groups from a geographical or economic point of view, providing everyone with the opportunity to visit a specific museum and promoting the connection between national and international schools. (e.g. in Palazzo Madama exclusive exhibitions for all).

Robot assisted museum guide improves employee's work/life balance and productivity. The robot will not replace employees, of course, but will offer them a lightning on some activities on one hand. On the other, will allow visitors to get more information about museum locations and additional details.

Narrative of the VR TV program: the user access RaiPlay and select the Travel documentary program episode dedicated to the city of Turin. A selection of different cultural sites is presented, and the user selects the Visit of the Chinaware Collection in the Palazzo Madama Museum of Torino.

4.2 Health Sector

4.2.1 Product/Service Characteristics

Healthcare is typically given in live face2-face engagements between patients and doctors. However, tele-health is a promising new way forward to improve on four important goals of healthcare, describes below.

1. **Patient experience**
   Tele-health can improve the patient experience due to that patients do not need to commute for consultation purposes and can feel safer because they do no longer need to be in close proximity of other people who could possibly carry the COVID19 virus or other pathologies transmissible by air. Also, for the chronically ill or patients that need regular checks after surgery, a tele health monitoring solution makes their lifes more easy, pleasant and safer to live, because they can move freely in and around their homes while their health can be surveilled continuously.

2. **Better health outcomes**
   Tele-health can contribute to better health outcomes in various ways. An example is advanced remote collaboration between healthcare professionals through video, patient records and radiology image sharing. This way, medical specialists are able to advice and assist care providers to improve the diagnosis and treatment of patient, wherever they may be. So, the best medical expertise can be provided anywhere, improving the health outcome for patients. Another example is the use of continuous remote patient monitoring to detect any form of health deterioration to provide the necessary care in-time as to prevent irreversible health damage to such patients.

3. **Lower cost of care**
   With respect to the overall cost of care, tele-health enables faster care, anywhere anytime, hence interventions can be done earlier in time so patients will recover faster such that overall costs are reduced. Also, medical experts do no longer need to displace themselves to provide support and care to other care professionals when needed, saving time and money.

4. **Improved staff experience**
   Finally, tele-health can improve the experience of the care professionals in multiple ways. First, the care professional's experience gets better when getting or supplying advice or assistance becomes more effective, hence less time consuming and less frustrating. Next, when medical patient information – as needed for decision making – is easily accessible, the healthcare professional will have a better work experience as well. And, as said before, if the time of the expert can be spent more effectively by replacing physical encounters by advanced tele-health collaboration services, then this also adds to a positive work experience of the healthcare staff.

These are related to a major value model in healthcare, called the quadruple aim [32], see Figure 8. Quadruple aim of healthcare..
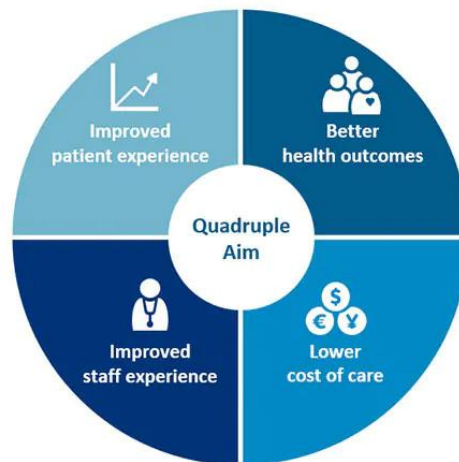
Figure 8. Quadruple aim of healthcare.

Telehealth has been given a boost recently due to the COVID19 pandemic, because it is the most effective way to realize social distancing and thus preventing the spread of the virus. This includes tele-consultation and tele-expertise. and even remote ultrasound diagnostics at the patient's home by a paramedic wearing protective clothing.

4.2.2 Market potential and innovation potential

5G network technology could become a game changer for healthcare by enabling advanced tele-health care scenarios to provide the best medical care anywhere and anytime.

Some examples of 5G enabled tele-healthcare are listed below:

- Artificial intelligent agents running in mobile edge computing resources (MEC) can provide real-time guidance for paramedics to perform the right diagnostic and interventional procedures. This will enable the less trained care professionals to do complicated medical tasks. This will prevent some human-error in clinical decision making, and increase serenity thereby lowering the burn-out percentage of medical professionals.

- Artificial agents in the edge will be able to perform advanced real-time diagnostics for ultrasound applications to help care professionals in ultrasound image interpretation.

- Highly adaptive connected medical mMTC devices to seamlessly stream health data of large and dense groups of patients to the cloud. This will impact the long-term medical cost-of-care efficiency and will reduce hospitalizations.

- Artificial intelligent agents in the cloud that perform non-stop health condition analysis for large groups of patients at the same time. This can improve the monitoring of patient cohorts, in particular for the purposes of epidemiological studies.

- Extending remote monitoring to remote diagnostics, to improve first responder accuracy in emergency situations. Increased data rates will be temporarily needed to improve the diagnostic quality on request of artificial intelligent data analysis agents, requiring monitoring devices to support multiple modes of operation and communication (MMTC, eMBB, uRLLC) that the 5G network must cater for.

- Screening, examination and monitoring of patients in remote areas with teleguided ultrasound for a large variety of pathologies, diseases and conditions, e.g. stroke, internal bleedings, liver fibrosis, bone fractures, COVID19 pneumonia, but also pregnancy.

- Remote consultations at large scale and with high resolution video communication or virtual presence through holographic devices such as HoloLens. This can replace face to face consultations to prevent the spreading of contagious diseases such as COVID19.

- Connect in real-time through 5G eMBB to patient records, including radiology and molecular data whenever needed. This will increase the accuracy of clinical data and prevent inconsistencies in critical medical data communication.

The different of tele-health options and potential market opportunity areas are illustrated in Figure 9. Tele-health solution area opportunities.

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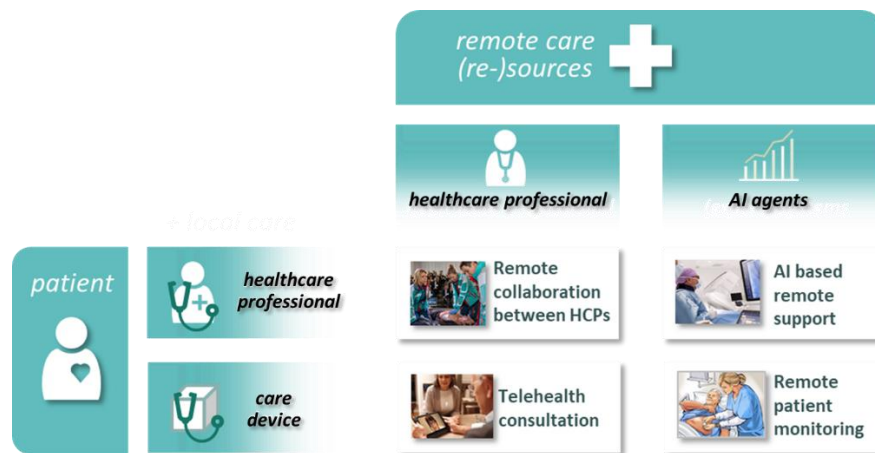
Figure 9. Tele-health solution area opportunities.

This figure shows the various tele-health communication use case types between the patient and a remote care resource. In particular, who or what is with the patient and who or what is the remote care resource. More precisely, the patient may be accompanied by a local care provider or may just have a communication or health monitoring device or both. The remote resource may be either a medical expert or an artificial intelligent agent.

This may result different scenarios:

1. Basic tele-consultation between a patient and a doctor, using only audio and/or video communication.

2. Patient monitoring based on a patient monitoring device and a remote artificial agent.

3. Collaboration between two care professionals, where one is with the patient, the other in the office or at home, typically a more experienced care professional.

4. Artificial intelligence-based guidance of a care professional who is with a patient.

Note that remote monitoring of patients who do not absolutely require hospitalization is already implemented on a large scale at this very moment to manage patients with COVID19. The situation is changing the perceptions and the acceptability of the society at an incredible speed. Technological infrastructures and mobile devices will have to be there to meet these new expectations.

4.2.3 Business opportunities

In today's professional healthcare, one can identify an eco-system or collaborating partners that includes among other things the manufacturers of medical equipment, system solution integrators, hyper scale cloud providers, medical professionals, insurance companies and payers (health consumers).

By introduction of advanced tele-health solutions, also network infrastructure providers and communication service providers (CSP) become part of the eco system, but now in a larger market. This is enabler for new business models and business opportunities.

The reason is that the variety of technology options that 5G can offer impose a different relationship between 5G CSPs, 5G network equipment vendors and healthcare solution providers than before. For example, manufacturing industries require 5G networks with different KPIs and deployment models than is needed for the touristic sector, automotive, agriculture, airports or healthcare. In manufacturing, most probably NPN networks with uRLLC characteristics will be deployed to control robots in real-time, while in agriculture mMTC technology will be mostly deployed for checking the condition of farmlands.

So, for each specific vertical industry also network equipment providers and communication service providers become part of the eco system, but now in a larger market. This is enabler for new business models and business opportunities, including special service level agreement and billing models. Figure 9 provides a simplified illustration for such an eco-system for healthcare, which has different CSPs in each geography.
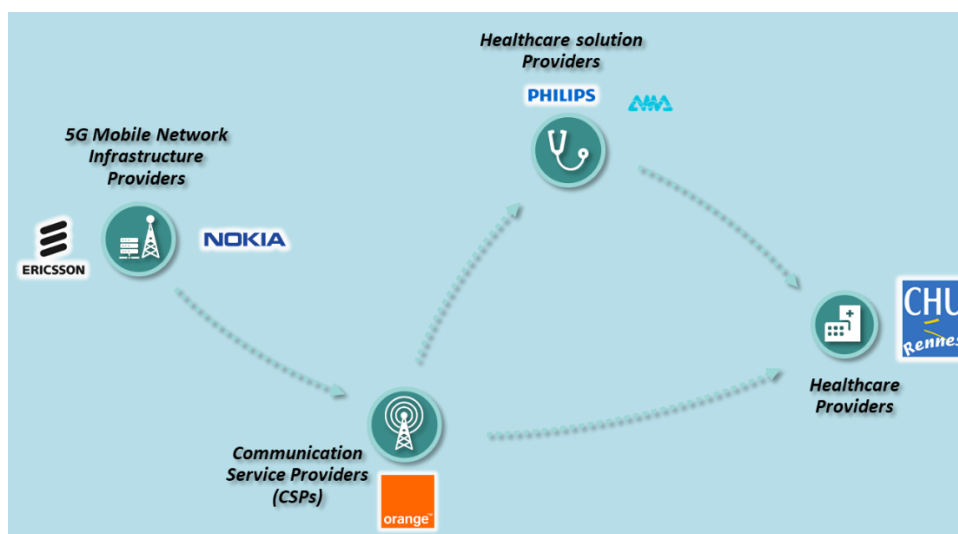
Figure 10. Increased eco-system complexity for 5G network usage in healthcare.

Figure 10 provides a simplified illustration for such an eco-system for healthcare, which has different CSPs in each geography.

4.3 Transportation Sector

4.3.1 Product/Service characteristics

Like the touristic sector, the transport one has also been confronted with an unprecedent decrease in passenger travel in an effort of each country to stop the spread of the pandemic and keep their citizens safe. In most of the countries international travel has been banned, while in others only "essential" travel is permitted for medical, repatriation and business purposes. Furthermore, there are hardly any major companies that permit, let alone encourage, their employees to travel as the companies will then be liable for their employees wellbeing and safety. The effect of the pandemic is devastating on the decrease of passenger numbers reaching up to 90% during the first months after the start of pandemic.

Apart, from the tremendous decline in passenger numbers, the duration of the pandemic -14 month since the first incident in Europe – is so protracted, that has intensified multifold the impact on the industry. This has led major airlines to suspend operations and airports to lockdown entire terminals. The impact of the COVID-19 pandemic on the industry, greatly surpass the effect of the September 11th, 2001 attacks on the twin towers at New York, due to the protracted period that these effects pertain.

It is evident that the impact on aviation of COVID-19 will be complex and long-lasting impacting the whole industry in general. Nevertheless though, following the advancements in the vaccinations in each country, a sign of hope for the recovery of the industry is becoming more and more evident. The much anticipated recovery though, will continue to be affected by the COVID-19 pandemic as the virus is expected to mutate multiple times and the need for new vaccines will continue, therefore we can no longer consider returning to a normal operating environment for our industry as we used to know it before the COVID-19 era, but rather a new one that will become the "new normal" for passengers to travel.

The "new normal" will have a large effect on the way we will travel in the future, many advocate that the effect will be similar to the 9/11 disaster where the focus of the industry shifted overnight to the security of flights and passengers. In this case the focus will shift to the safety and hygiene of the passengers, employees and airline crews during their journey in/out the airport and during their flights.

Technology is expected to play a vital role to this shift of focus through the introduction of new services that will make use of the technologies that will allow for the trustworthy exchange of information in a massive manner and in real time. The focus will be to the:

- exchange and verification of passenger health passports;
- display of proof of certified for travel passengers;
- detection of passengers not fit for travel;
- location based information of passengers;
- detection of interactions of passengers within the airport and flights and notification in case of close of contact with a confirmed COVID-19 case;
- gathering and analysis of multiple data sources (health records, positive cases, travel, environmental spatial, demographic information etc.) to detect patterns related to COVID-19, measure the performance of mitigation measures and identification new ones;
- use of IoT and "wearable sensors" that can detect and communicate vital health parameters.
- deployment of extended reality applications for passengers to communicate important health information.

In general, the 'new normal' for the aviation industry will built upon the formation of a more digitized passenger experience right through from start to finish. The "new normal" will capitalize on the latest technological advancements and expedite the already ongoing digital transformation of the transportation industry. Passenger experience, efficiency, secure travel, cost optimization, increasing demand for air travel were the key drivers for the digital transformation up to now in the transport industry. Health and hygiene will be added to these drivers and technological based offerings will need to adopt and accommodate accordingly.

4.3.2 Market position and Innovation potential

The transport sector and particularly the aviation one, in the post COVID-19 – "new normal era" will focus into creating, ensuring and communicating to all involved stakeholders trust. In this context we expect to see the industry's innovation efforts towards the following areas:

- Frictionless/Seamless/touchless Passenger journey

The new end-to-end travel experience must facilitate social distancing and hygiene, as it is essential to provide peace of mind to travelers that they are safe before, during, and after a flight. While passenger processing has previously been focused on speed, there is now an additional need for hygiene. Passenger-facing technologies are expected to transition from now outdated touchscreens and face-to-face check-ins to touchless systems that interact with passengers in alternative ways. The use of biometrics will greatly expand to almost all phases of the passenger journey as they provide an indisputable technology for person identification.

- Fit for travel passengers

Secure and trusted platforms that will be used to exchange certificates and passenger information regarding their fit for travel status based on the passenger's medical records. Additionally, when the use of wearables and IoT technology progresses, in conjunction with a robust framework around the sharing of sensitive personal information, the journey and interactions of passengers within the airport and flights will be correlated and in the case of close of contact with a confirmed COVID-19 (or another infectious disease transmitted by air and/or contact) case all affected persons will be automatically notified.

- Digital personal assistants

Airports are capitalizing on the widespread use of smart devices from passengers to provide services that up to the COVID-19 era they would be provided by airport/airline employees. Digital customer services representatives, chatbots, video calls with airport & airline customer support, digital concierge, digital personal shoppers, automated way finding assistants (both virtual and robotic ones), proximity and location based services, real-time translation services offering multi-language options are expected to rise in popularity significantly in the "new normal" era.

The 5G-TOURS innovations that are currently being researched cater for many of the above innovation areas, as they already research the massive deployment of IoT sensors, streaming of 4K resolution videos, wayfinding and location-based services for the airport use cases. All these areas make use of the capabilities of 5G based

mobile networks especially the ones that require high bandwidth and use by a very large number of users such as in airport terminals, stadiums, expo events etc.

Furthermore, the wide range of automated objects and sensors, connected via 5G networks, will produce massive amounts of data. With the use of 5G mobile networks these data will be transferred in real time to data analytics platforms. These data can be used to produce descriptive, predictive and prescriptive algorithms that will lead to defining unprecedented situational awareness and enable the mitigation of incidents before they even take place. Disruptions can be managed before they even occur. Artificial Intelligence (AI) algorithms will bring real-time operations to life for all stakeholders. Taking data from across the entire aviation value chain, will enable airports to visualize, simulate and foresee what will happen next.

The entire ecosystem of devices, data sources, platforms and end users, needs a solid data communication framework, capable for the exchange of massive amounts of data, from large number of sources delivered in real-time to processing platforms and end users. 5G based mobile networks are not only capable but with the superior characteristics that are based on Enhanced mobile broadband (eMBB), Massive machine type communications (mMTC), Ultra-reliable, low latency communications (URLLC), they facilitate the innovation efforts on researching new solutions and services.

4.3.3 Business opportunities

The business opportunities in the "new normal" era can be found around the solutions, products and services that will cater for establishing trust for passengers to travel, such as information and biometrics capturing and sharing platforms, that will be utilized from all industry shareholders to facilitate travel in a safe manner. 5G based mobile networks can further promote the realization of this process by utilizing the advanced 5G network security characteristics such as encryption, integrity protection and advanced authentication features. The consequence of employing 5G based mobile networks will be to further enable trust to all travel and transport stakeholders, thus accelerating the swift recovery of the travel & transport sectors, as they will provide an undisputable and secure method to exchange sensitive personal and medical information.

Digital platforms that will provide electronic services that were typically serviced by humans, such as information agents, salespersons, airlines and airport employees, will also find a very positive ground for being established, as passengers start shifting their interaction preferences to these platforms for safety and hygiene reasons.

In a similar manner, solutions and products that provide digital and robotic assistants will also find their place in the transportation sector, as they will help minimize the number of physical interactions between passengers and those persons that provide these services.

Proximity, location based and way finding services, assisted by AR/VR ones, will help passengers to autonomously navigate within even the most complex and unfamiliar venues. During this process the passengers can receive status information regarding their flights and how they can efficiently optimize their journeys according to their preference such as shopping, dining, visiting a business lounge or having an online collaboration with colleagues.

Furthermore, the platforms responsible for the above services can interface with other platforms and allow for personized marketing campaigns and commercial initiatives maximizing business revenues and minimizing customer engagement costs for retailers.

Finally, through the proximity, location based and way finding services, passengers can report their status and location to airport operators and airline personnel so that they can efficiently plan and monitor their processes (e.g. queuing for security checks, aircraft boarding, pax flow management etc.). Similarly, passenger can transmit their vital health indications to health authorities, in an effort to further enhance passenger trust and their fitness for travel in order to protect general public and contribute towards the impediment of COVID-19 virus spreading.

4.4 The Mobile network Sector

In addition to 5G technology to develop innovations across several sectors and vertical industries, as explained above, another very relevant focus for 5G-TOURS innovations is the mobile network technology itself. Indeed,

beyond using existing 5G technology, 5G-TOURS enhances it with novel functionality, leading to novel 5G products and services.

To support the project innovation within the mobile network sector, 5G-TOURS Innovation Management is addressing the following aspects:

- The assessment of the different innovations within the project to identify opportunities for commercial impact. In this context, WP3 plays a major role, by developing the novel ideas and solutions that could generate commercial value.
- Provide guidelines and take necessary steps to ensure that the market will leverage the potential of these innovations. In this context, WP8 plays a decisive part by coordinating the standardisation and patent work and orchestrating the dissemination activities.

In the following, we report on the progress of Innovation Management in this context. We first describe the mobile network products and services resulting from 5G-TOURS. Then, we explain the key innovations behind these products and services will rely. Next, we describe the market position to exploit these innovations. Finally, we explain the activities that are being taken by the project to realize the exploitation potential of these innovations.

Note that this section has a different structure from the previous ones, as it addresses innovation in terms of technology. In this case, the business models and stakeholders are the traditional ones for the mobile network ecosystem, i.e., manufacturers and operators, in contrast to the previous sections which were dealt with emerging markets. Beyond the key 5G characteristics that are part of the state of the art in 5G technology, 5G-TOURS fosters novel innovations that strengthen mobile network products. The main focus of this section is the efforts to pave the path towards the commercialization of these innovations.

4.4.1 Products/Service Characteristics

5G-TOURS innovations aim not only using 5G technology but also at developing novel 5G network solutions. These solutions will build on the equipment provided by the manufacturers of the consortium, compliant with the latest 3GPP releases, comprising network infrastructure equipment, mobile terminals and chipsets, and will incorporate the enhanced functions on top of baseline products. In particular, these are the products being addressed by 5G-TOURS:

- *RAN and core network equipment*: Development and implementation of network equipment conforming that incorporates novel 5G-TOURS functions;
- *Chipsets for mMTC*: Implementation and integration within vertical sensor solutions of chipsets for mMTC communication;
- *Mobile terminals*: Deployment and integration with vertical solutions of mobile terminals conforming to the latest releases.

In addition to the above products, another major target addressed by 5G-TOURS are the novel network services that can be provided with network slicing, one of the key technologies addressed by the project. In addition, 5G-TOURS aims to provide new and customized mobile communications services, reaching new application domains with specific requirements. Hence, a major innovation of 5G-TOURS in the mobile network involves the provisioning of novel services by network operators. This is related to the innovations address in the previous sections from the mobile network operator's angle.

4.4.2 Key mobile network innovations

The project is working towards incorporating novel enhanced functions to the mobile network architecture on top of the existing baseline functionality. By adding this novel functionality into the network equipment, 5G-TOURS aims to improve the performance and operation of 5G equipment. The ultimate goal of 5G-TOURS is to bring these innovations on network technology to commercial exploitation. In the following we explain the novel technology ideas that the project is focusing. In particular, these are the key innovations that the project is working on:

- *Enhanced MANO and AI orchestration*: One of the identified features to experiment as an extension of the existing MANO solutions is the deployment of Artificial Intelligence agents for network service optimisation. The usage of the ETSI OSM solution as NFV Orchestrator give us the opportunity to

enhance OSM towards providing features that could be applied in the 5G-TOURS use cases and to create a relevant impact in the Open Source community by contributing to the ETSI in the evolution of the Open Source MANO (OSM) solution.

- *Broadcast support*: The ability to provide multicast/broadcast communications is viewed as a basic requirement in 5G systems. Enabling point to multipoint transmissions in the 5GC increases the efficiency in the network resources used, avoiding possible congestion occurring inside the transport network. 5G-TOURS is devising technology to deliver high-quality multimedia content distribution, both using the LTE-based 5G Broadcast and the 5G-Native variants. The outcomes are performed in two trials inside Use Case 4: UC4.b and UC4.c. The first trial uses state-of-the-art Rel-16 LTE equipment and the second one will use beyond state-of-the-art technology via software prototyping and simulated RAN environments, adapting the most recent Rel-17 3GPP standardization work.

- *Service layer*: The service layer aims at providing easy-to-manage interfaces to establish and operate network slices for various industrial verticals such as multimedia, e-health, transportation and robotics. The service layer enables network slice instantiation, monitoring, orchestration and operation. The service layer also handles new network functions dedicated to the support of broadcast/multicast in 5G. An analysis of the expectations of verticals for the service layer was performed by circulating a questionnaire to the target UC owners. The expressed requirements were broken out into three categories: Network Slice Management, Slice Monitoring, and Network Exposure. These requirements induce a complex management system driving the innovations for enhanced MANO and AI orchestration. The service layer design and implementation is highly dependent of the MANO technologies, leading to several tailored implementations associated to specific MANO innovations and specific use-case requirements.

The above innovations will particularly impact 5G core network products, which will be able to provide enhanced interfaces to the network slice tenants (such as verticals) and rely on novel techniques to provide an improved management and orchestration of the whole network.

4.4.3 Market position and business opportunities

In the following we review the context and market positioning of Europe in general and 5G-TOURS partners in particular, to leverage the project innovations to exploit potential business opportunities.

Europe has traditionally been very strong in the development of mobile networks technology, in contrast to other technologies such as the Internet which have been largely led by other world regions, mainly the US. As a matter of fact, Europe has largely dominated the mobile network market since the development of the GSMA technology, and even today Europe plays a leading role in the development of mobile network infrastructure equipment. Yet, there are some areas within the mobile communications market where Europe's position is much weaker. And there are also new areas that will emerge with 5G technology and it is yet to be seen who will take the leadership in these emerging markets.

5G-TOURS aims to (i) reinforce European leadership in those areas where Europe retains a strong position, (ii) strengthen its position in those areas that are currently dominated by other world regions, and (iii) contribute to Europe's positioning in the new opportunities and ecosystem that will be created around 5G technology. In the development of 5G technology, 5G-TOURS aims to strengthen European leadership in the following areas:

- *Mobile network infrastructure*: This market is largely dominated by European manufacturers nowadays, namely Ericsson and Nokia which jointly account for a substantial fraction of the market share. 5G-TOURS involves both Ericsson and Nokia, and aims to provide them with novel technological solutions, valuable trial experiences as well as the exposure to new vertical solutions and ecosystems, contributing to strengthen the European leadership in this area;

- *Baseband processors*: This market is largely dominated by non-European players, Qualcomm being the market leader with a share above 50%. While Europe's position in this market is rather weak, the 5G-TOURS consortium includes the most important European player in this market, Sequans, which supplies the IoT market. 5G-TOURS can provide Sequans with the opportunity to enter vertical markets of high potential, teaming up with partners as strong as Philips;

- *Mobile phones*: This market is also dominated by non-European players. The consortium includes however one of the largest worldwide manufacturers in this area, Samsung, which despite being a non-European company has an important presence in Europe and plays a leading role in many European initiatives such as ETSI. Samsung's participation in 5G-TOURS can strengthen its European profile and its collaboration with the main European players;
- *Mobile network operators*: The consortium includes three of the largest mobile network operators in Europe: Orange, Telecom Italia and OTE (part of the Deutsche Telekom group). 5G-TOURS focuses on new markets and revenue streams for operators and is providing the operators of the consortium with valuable trial experiences as well as exposure to ecosystems around the new markets, thus strengthening the position of the European operators.

4.4.4 Promoting the adoption project innovations

One of the main goals of 5G-TOURS is to promote the technology innovations of the project and foster their adoption in the market. In the following we explain the actions that are being taken by the project in order to promote the commercialization of these innovations and foster their adoption in future mobile network products. In order to promote the project innovations in this sector and exploit the potential business, 5G-TOURS is pursuing the following goals:

- *Attracting vertical industries* to use 5G-TOURS technology; indeed, verticals are the end customers of the technology and the success of the technology ultimately depends on reaching a critical mass of customers;

- *Fostering the widespread adoption of the technology* beyond manufacturers and operators of the consortium; as a matter of fact, in a global market such as the mobile telecom one, a technology can only succeed if it is widely adopted by the majority of the players in the market.

In particular, the measures taken by the project to achieve these goals include the following:

- Carrying out market analyses that highlight the business opportunities enabled by the solutions developed in 5G-TOURS and stimulate a widespread adoption of the technology. In particular, 5G-TOURS is conducting analysis to evaluate the revenue that verticals may obtain by applying 5G technology in their businesses.

- Building an ecosystem in line with the exploitation plans of the partners involved in the project, so as to foster the rapid commercial utilisation of the 5G-TOURS technology. As a matter of fact, each of the 5G-TOURS use cases involves major European players of the corresponding sector. This initial experience of collaboration between the different players can provide the basis for future business relationships.

- Promoting the standardisation of the key interfaces into the relevant standards bodies and groups, in order to facilitate the use of the technology and to stimulate its adoption by other market players beyond those actively involved in the consortium. Notable results so far include the standard proposals at 3GPP as well as the activities within ETSI ENI.

- Patenting key ideas with potential commercial impact. 5G-TOURS has already issued a number of patent applications to protect the commercial interests of the corresponding organizations and thus foster the commercial exploitations by those partners.

- Providing an open source software. In terms of open-source software, over the last years, we have observed a paradigm shift in the telecom industry towards open source software, which is particularly visible in the SDN and NFV technologies. The key advantages of products based on open source are as follows: (i) open source can gather a critical mass of effort that allows pursuing projects that would be too large and effort-consuming for a single manufacturer; (ii) by relying on open source based products, mobile operators are not bound to a single manufacturer and can easily change to other manufacturers using the same open source software. Following these trends in the mobile network industry, 5G-TOURS is working on open source software for some of its solutions.

In the following table, we describe the various activities that are being carried out to promote the future market adoption of the key 5G-TOURS innovations around the mobile network technology.

Table 7. Activities to promote market adoption.

Key 5G-TOURS innovation	Activities conducted to promote the commercial adoption of the project innovation
Enhanced MANO and AI orchestration *Novel service layer*	• Proposal of the project solutions to ETSI standards, in particular to ENI ISG. • Development of a prototype which is an official Proof of Concept of ETSI ENI. • Contribution to 3GPP standardisation. • Development of a prototype that may become Open Source. • Demonstrator to show the functionality provided. • Patenting some key ideas
Novel broadcast solutions	• Contribution to 3GPP standardisation. • Development of a prototype. • Patenting key ideas.
Novel service layer	• Interaction with vertical partners to design of a novel interface that meets their requirements. • Development of a visualization tool to show the operation of the network. • Development of a prototype that may eventually become a Software Development Kit that can be shared with vertical players.

As a conclusion, Innovation Management is closely monitoring the mobile network innovations addressed by 5G-TOURS, guiding the various activities to strengthen the commercial value of these innovations and ultimately promoting the adoption of these innovations in the market in various ways.

5 Standardization and Intellectual property

This section reports the activity on standardization. We have focus where the major impact should be mentioned. Some of these items are a continuation of existing activities. Some others such as 5G MAG, TIP have been initiated during the last period.

Currently, 110 contributions have been accepted by the different standardization Groups. Out of 110, 85 are considered as Major contributions.

These contributions are motivated by the implementation of the different UCs and aim to fill identified gaps.

Table 8. Standardization Contributions.

Major contribution (Feature -Work item / Study item contribution)	Minor contribution (Correction / Editorial / Duplicate)
85	25

5.1 Contributions in 3GPP Technical Specification Groups (TSGs) and Working Groups (WGs)

The following aspects have been followed during this period: Cellular-IoT (CIoT) technologies (i.e. LTE-M and NB-IoT), mMTC evolution, Broadcast/multicast.

5.1.1 Cellular-IoT (CIoT) technologies

The aspect of NB-IoT UE Specific DRX was brought in RAN2 at a late stage during the Rel.16 NB-IoT enhancements work item [6]. Sequans raised a lot of issues, helped with proposals (for example, positive outcome was the introduction of one SIB parameter that Sequans initially proposed within our technical contribution) and also led as rapporteur for 3 related discussions. In addition, several corrections were proposed and agreed, in collaboration with other companies, to correct eMTC reception types in 36.302 from Rel-13 forward in order to reflect what was specified in PHY spec.

In parallel, the Rel-17 study item "NR RedCap" started in 3GPP, regarding the design of reduced capability NR devices which is targeted to specify the first NR-based IoT-flavoured devices [7]. Sequans contributed to RAN plenary discussions in order to help revise and scope the study item's description and objectives, especially the data rates requirements for high-end wearables use case. Several technical documents were also provided in RAN1 meetings wherein Sequans contributed views, proposals and discussion on all the issues raised during the life of the study, helping on aspects to focus for the upcoming standardization of RedCap relevant features.

5.1.2 mMTC evolution

Finally, another mMTC relevant work item, called "NR IIoT URLLC" was ongoing during this year [8]. Its standardization objectives include, among others, enhancement aspects regarding NR-based Industrial IoT (IIoT) and Time-Sensitive Networking (TSN). Sequans provided views and suggestions to RAN2 regarding RAN impacts of SA2 work on uplink time synchronization for TSN, propagation delay compensation enhancements, and mobility aspects. Especially for the latter, Sequans demonstrated that no additional work is needed and the output of the final related RAN2 meeting was well in line with our specific proposals.

5.1.3 Multicast/broadcast

Currently, architectural enhancements for 5G multicast/broadcast are being standardized by 3GPP. 3GPP research is being approach by two different angles, one of them considering multicast/broadcast communication as a Resource optimization service over Unicast systems (Operator perspective) and the second one considering multicast/broadcast as a service itself (broadcaster perspective). The first approach is being studied inside a Study Item named "Study on architectural enhancements for 5G multicast-broadcast services" ended in December 2020. This Study Item aims to enable general MBS over 5G Systems specially targeting Transparent

IPV4/IPV6 multicast delivery, V2X, Public Safety, IPTV and IoT use cases. The outcomes related to this item are reflected in TR 23.757 [29] and concluded with the need to include multicast functionalities inside the 5GC. For that reason, a new Work Item was approved named "Multicast-broadcast services in 5G".

The architecture for 5G-multicast in the 5G-core is specified by SA2 in TR 23.757 (3GPP, TR 23.757: Study on architectural enhancements for 5G multicast-broadcast services) in annex A.3. This architecture, illustrated in Figure 11 captures the 3GPP SA2 working group agreements.
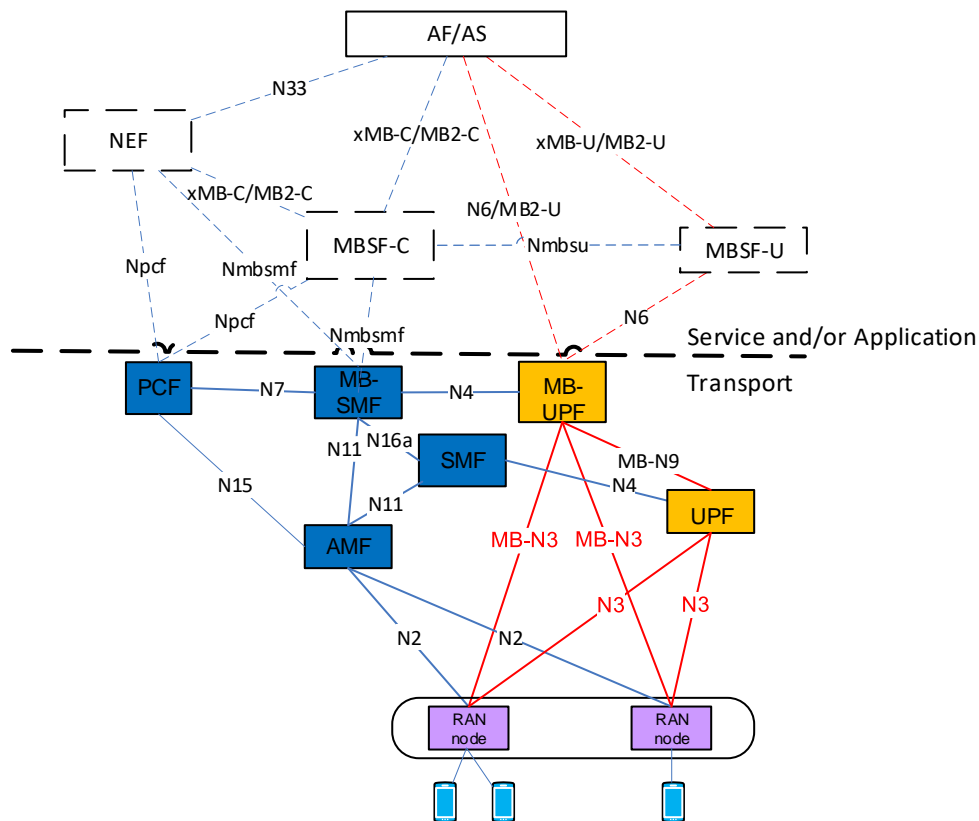
Figure 11. Reference architecture for 5G multicast/broadcast services.

2 new entities are defined in the 5GCore transport layer:

- **Multicast Broadcast SMF (MB-SMF)**: the MB-SMF is used for session management (including QoS control), and control of multicast transport, including configuring the MB-UPF and RAN (via AMF) for multicast/broadcast flows transport based on the policy rules for MBS services from PCF or local policy.

- **Multicast Broadcast UPF (MB-UPF)**: The MB-UPF is used for delivery of MBS flows to RAN (or UPF for individual delivery) and QoS enforcement for MBS services. The MB-UPF performs the following functions to support MBS:
   • Packet filtering of incoming downlink packets for MBS flows.
   • Distribution of MBS data packets to RAN nodes (or UPF nodes).
   • QoS enforcement (MFBR) and counting/reporting based on existing means.

The 3GPP SA4 working group is currently studying the evolution of the 5G Media Streaming architecture (5GSM) within TR 26.802 (3GPP, TR 26.802: 5G Multimedia Streaming (5GMS); Multicast architecture), and is considering in particular the delivery stack (delivery protocol over UDP, signalling/service announcement, forward error correction, etc.). We can expect that the same delivery stack as the one offered by the BM-SC for Multimedia Broadcast Multicast Service (MBMS) in LTE. Enensys participates actively to that task.

5.2 Contribution to 5G MAG

The 5G Media Action Group – 5G-MAG – is a cross-industry organization providing a framework for stakeholders across the media sector to collaborate on a market-driven implementation of 5G solutions capable of meeting the requirements for the production and distribution of audio-visual media content and services. Stakeholders include content and service providers, network operators, technology solution suppliers, equipment manufacturers, R&D organizations, regulators and policy makers.

The development and deployment of 5G technology is one of the key topics around the globe today. While previous mobile technologies established a closed communication universe, 5G introduces a paradigm shift with respect to industry engagement, new services and business opportunities in many market sectors. The global media industry is one of these sectors, where huge benefits are expected along the entire value chain. The vision of 5G-MAG is to facilitate and foster the use of 5G technology in the global media sector, from the CREATION of audio-visual content and services, DISTRIBUTION across networks, and on to the CONSUMPTION of audio-visual media. 5G-MAG strives to enable the markets, thereby creating a win-win situation for all stakeholders along the media value chain.

The association aims to:

- Identify relevant use cases in the global media industry where 5G may be beneficial.
- Define the technical functionalities of the equipment required to enable these use cases, including chipsets and user devices.
- Estimate the volumes of user devices, chipsets and related required equipment by the global market together with a timeframe for their availability and deployment.
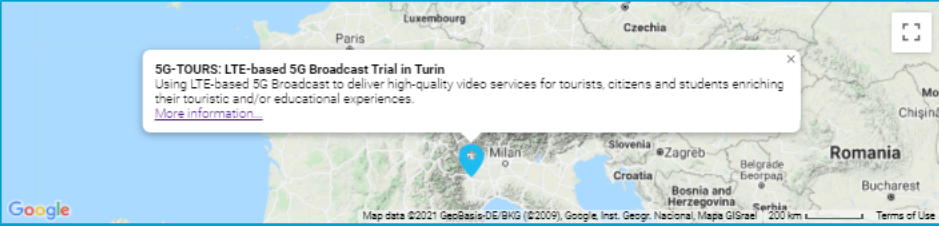
Engage and liaise with relevant stakeholders along the entire media chain, to explain the motivation, understand potential issues, identify opportunities, and find a way to unlock benefits and create added value for all.

Technical standardization work is not conducted in 5G-MAG. However, 5G-MAG provides a platform to leverage and facilitate standards adoption and monitor activities relevant for the media industry. 5G-MAG also enables a framework to motivate and support the running of trials, and disseminate their results, as it brings together relevant stakeholders under one common goal.

UC4 will be submitted to 5G-MAG, showing use 5G for content distribution. Also, UC5 could be a relevant example of adoption of 5G for content production. RAI inserted UC4 among the trials and projects using 5G for content distribution [28] (see Figure 12. TRIALS 5G FOR DISTRIBUTION [27].

TRIALS 5G FOR DISTRIBUTION

TV to handheld devices using LTE-based 5G Broadcast

5G-TOURS: LTE-based 5G Broadcast Trial in Turin
Using LTE-based 5G Broadcast to deliver high-quality video services for tourists, citizens and students enriching their touristic and/or educational experiences.
More information...

Participants:
- RAI (Public Service Media Organization - TV Content Provider - Broadcast Network Operator)
- UPV Universitat Politecnica de Valencia (Academic institution)
- Enensys EXPWAY (manufacturer of Broadcast Network Equipment and Test & Monitoring Equipment for digital broadcast)

Services
- Delivery of high-quality video services for tourists, citizens and students enriching their touristic and/or educational experiences

Duration
- FeMBMS Rel-14 (Q4 2020), LTE-based 5G Terrestrial Broadcast Rel-16 (2021)

Location
- Turin (Italy)

Technologies
- FeMBMS (Release 14) / LTE-based 5G Broadcast (Release 16)

Equipment and Infrastructure
- One HPHT transmitter site, EnTV/EPC core by Rohde & Schwarz, hardware/software defined receiver (SDR) by Rohde&Schwarz and iFN

Spectrum / Frequencies
- VHF 11 (216-223 MHz, center frequency 219,5 MHz)

Main goals
1. 5G Broadcast delivery to massive audiences with HPHT infrastructure
2. Study the performance of a 5G broadcast signal in mobility (in car scenario) and urban outdoor
3. Improved video user's experience
4. Distribution of audio-visual (A/V) content and services to a potentially unlimited number of users

Figure 12. TRIALS 5G FOR DISTRIBUTION [27].

5.3 Contribution to DVB

The DVB (Digital Video Broadcasting) [25] is an Alliance of about 200 companies, initially of European origin but now worldwide. Its objective is to agree specifications for digital media delivery systems, including broadcasting. DVB is responsible for the successful definition of standards for digital television broadcasting and multimedia broadcasting. More recently, the work of DVB has been focusing on services which may be enjoyed on devices, such as Connected-TVs and tablets or smartphones, connected to broadband networks. The disruptive impact of 5G in the Media sector will bring new value to the broadcast technology, offering new opportunities for increasing.

The objective of the project is to follow the initiative DVB-I over 5G [26]. A DVB study mission on 5G had previously noted three areas of particular interest for DVB services: 5G unicast, 5G broadcast, and 5G fixed wireless access. With the work on broadcast and media streaming in 3GPP Release 16 nearing completion, the DVB Steering Board has tasked the CM-I working group with the capture of commercial requirements for the use of DVB-I as a 5G media service layer. The end goal would be an integrated solution that permits the distribution of a DVB-I service over multiple distribution means, in the context of, but not limited to, 5G delivery.

5.4 Contribution to IHE DEV

The IHE Devices Domain (DEV) was created in 2019 as an expansion of the original Patient Care Device Domain (PCD). The purpose was:

- to support the emergence of IoT and Big Data analytics that have an insatiable hunger for massive, granular sensor and device data,
- to provide real-world evidence to both develop and validate next generation health technologies and protocols,
- to engage industry to guide development, implementation and conformance assessment and interoperability of personal and clinical apps and devices. Along with regulated Patient Care Device, DEV now includes Personal Connected Health (PCH) and the Device Point-of-Care Interoperability (DPi).

These three groups are mostly autonomous Programs within the Devices Domain, addressing different clinical needs and use models:

- Patient Care Device (PCD) - PCD Wiki page [15]

- Personal Connected Health (PCH) - PCH Wiki page [16]

- Device Point-of-Care Interoperability (DPI) - DPi Wiki Page [17]

More info is available in [18] [19] [20].

The 5G TOURS objective is to propose an advancing interoperability from home to hospital to lay the foundation for innovation and furthering health knowledge and state-of-the-art healthcare internationally.

We have performed the following actions during the las period:

- Contributed to the proposal to create a new IHE DEV Profile for Direct-to-Cloud-Constrained Devices [21] that transports heath data according to IEEE 11073-10206 ACOM.

- Coordinated from PCHA [9]/ IHE DEV [22], made key contributions to the IEEE 11073 PHD Working Group's Abstract Information Content Model (ACOM) – a new stand-alone simplified information model independent of the transport technology. Once released, ACOM will become the IEEE 11073-10206 standard [23] (4-min teaser video publically available here).

- Coordinated from PCHA / IHE DEV, led a New Work Proposal (NWP) to create a Bluetooth Generic Health Sensor (GHS) service and profile that transports heath data according to IEEE 11073-10206 ACOM. The proposal was approved and work on functional requirements has started within Bluetooth SIG under Philips leadership.

- Stepped up as Chair of Bluetooth SIG's Medical Devices Working Group [24].

5.5 Contribution to TIP

The Telecom Infra Project (TIP) [14] is a global community of companies and organizations that are driving infrastructure solutions to advance global connectivity. Half of the world's population is still not connected to the internet, and for those who are, connectivity is often insufficient. This limits access to the multitude of consumer and commercial benefits provided by the internet, thereby impacting GDP growth globally. However, a lack of flexibility in the current solutions – exacerbated by a limited choice in technology providers – makes it challenging for operators to efficiently build and upgrade networks.

The objective is to evaluate the creation of a group in order to define a profile for the usage of multicast/ broadcast in LTE/5G. Enensys follow actively this activity.

5.6 Contribution to OSM

OSM [10] is delivering an open source Management and Orchestration (MANO) stack aligned with ETSI NFV Information Models. As a community-led community, OSM offers a production-quality MANO stack that meets operators' requirements for commercial NFV deployments.

Atos is part of the OSM TSC (Technical Steering Committee) so Atos is quite well positioned in this community. Our 5G TOURS Objectives are:

- To contribute OSM with ideas and concepts discussed as part of the 5G-TOURS Project and, if possible, even with code.
- First potential contribution (code included): AI-models service component.

We have performed the following actions during the last period:

- OSM Release NINE launched [12]
- OSM PoC 11 Deployment of AI-Agents in OSM accepted at #OSM10hackfest [13].
- Targeting the first contribution with basic functionality for next OSM release 9 (November 2020). Full functionality foreseen to be included in releases 10/11.
- OSM technical committee agreed to our proposal for integrating the AI-Agents feature into that open-source platform. The proposal was well received, and no major objections to the proposed architecture were received.

5.7 Contributions to PCHA

PCHAlliance [9], a membership-based HIMSS Innovation Company, accelerates technical, business and social strategies necessary to advance personal connected health and is committed to improving health behaviors and chronic disease management via connected health technologies.

The goal of the Personal Connected Health Alliance (PCHAlliance) is to enable the seamless flow of personal health data from devices to the service providers in a secure, consent enabled and efficient way to produce a consistent set of medical grade, certified data to be used by healthcare professionals. Indeed, ensuring the quality of medical data captured from a variety of vendor neutral solutions is a key aspect when considering the scope of use cases across eHealth and the number of devices that can be used in the treatment of patients. Using 5G technologies will further increase the number of devices that can be used to treat a patient, which strengthens the requirement for accurate timestamping and authenticity of data from multiple sources.

We have performed the following action during the last period:

- Coordinated from PCHA / IHE DEV (*Note that PCHA and IHE DEV are operating together since late 2019)*, made key contributions to the IEEE 11073 PHD Working Group's **Abstract Information Content Model (ACOM)** – a new stand-alone simplified information model independent of the transport technology. Once released, ACOM will become the IEEE 11073-10206 [30] standard (4-min teaser video publicly available [31]).
- Coordinated from PCHA / IHE DEV, led a New Work Proposal (NWP) to create a Bluetoot **Generic Health Sensor (GHS)** service and profile that transports heath data according to IEEE 11073-10206 ACOM. The proposal was approved and work on functional requirements has started within Bluetooth SIG under Philips leadership.
- Leadership positions: Continued holding a PCHA GTC Co-Chair position. Stepped up as Co-Chair of the IHE DEV Domain. Also stepped up as Chair of Bluetooth SIG's Medical Devices Working Group.

5.8 Patents

The project is actively pursuing the application of patents in order to promote the exploitation of the project results and protect the commercial interests of the involved patents. As 5G-TOURS puts a strong focus on the deployment and use of the mobile network technology to provide different applications and use cases, there not may be as much emphasis on the creation of IPR as compared to other projects that strictly focus on the creation of mobile network technology. In spite of this, there have already been some results in terms of IPR (Intellectual Property Right), and additional results are expected by the end of the project.

To capture the project impact in terms of IPR, 5G-TOURS monitors the results in terms of patents related to the project. These correspond to patents that have been authors by researchers working on the project, during the lifetime of the project and in technologies that are closely related to the topics addressed by 5G-TOURS. Up to now, there have been the following results in terms of patents related to the project:

- Ericsson Italy has already issued a patent application related to the project. Ericsson is a large manu-facturer producing network equipment and thus it is expected that it will greatly benefit from the project results to develop more competitive and innovative products;
- Samsung UK has a strong activity in innovation. Up to now, the people involved in 5G-TOURS have been independently involved in 2 patents whose topics are related to the topics addressed in 5GTOURS.
- UC3M researchers involved in 5G-TOURS have filed one patent on 5G technology topics related to 5G-TOURS.

6 Industrial Communication and Dissemination

At the current stage the project has already achieved a substantial impact in terms of dissemination activities. The number of dissemination activities related to international journals and conference papers has reached the target of 25 contributions. Regarding the number of keynotes and panels together with the participation in 5G events, dissemination has already reached the number of 40.

The main following dissemination channels are: blog post, newsletter, press releases, webinars.

Unfortunately, the COVID-19 outbreak has been impacting some promotion events where 5G-TOURS have been planned to attend in 2020. Most of major conferences were organised online. At the moment three industrial workshops organising by the 5G-TOURS are planned for the end of this year in Turin, Rennes and Athens. Probably, these events will also be organized online or at least in mixed format (a part of attendees offline and another part online). Project has prepared several demo videos about the UCs. These videos are available on the website: http://5gTOURS.eu/videos/ and on 5G-TOURS official YouTube channel: https://www.youtube.com/channel/UCYdXMN027pe_Nkc6Hr92-Mw.

Interested consortium members (UPV, SRUK, ATOS, TIM, BCOM and UC3M) have already presented their achievements during seven organized webinars in 2020 and in February 2021. All these webinars are available on the official 5G-TOURS website and YouTube channel.

To promote the project website and project partners' achievements it was decided to prepare blog posts. Currently, 13 blog posts were published.

In November 2020 5G-TOURS issued the first Newsletter, which was distributed among more than 200 institutions from academia, industry, verticals, etc. The second issue is planned for April 2021.

Finally, all the targeted public deliverables were submitted as scheduled, and made available in the project website http://5gTOURS.eu/deliverables/.

All these mentioned above dissemination activities have helped to reach a large number of people from academia, industry, civil society, media, etc.: in particular, 4600 people from the scientific community, 3271 people from the industry, 91 people from the civil society, 1830 people from the general public, 354 policy makers, 509 people from media, 712 customers and 1174 people from others sectors. In total, 12541 people have been reached with the 5G-TOURS dissemination activities. These estimates were obtained based on the analysis of the involvement of the audience in social media, website traffic, and the number of participants in various events where partners participated.

6.1 Journal Articles and Magazines

5G-TOURS partners are targeting and have been publishing at the most prestigious journals and magazines in the field. The main results of 5G-TOURS project have been published during the first year in 3 journal papers and 1 book chapter and during the second year in 6 journal papers and 2 book chapters. The full text can be found in (http://5gTOURS.eu/journal-papers-books-and-chapters/). 5G-TOURS is also planning a number of Journal papers in special issue of an IEEE Journals. The joint work between partners is also highlighted.

Table 9. Journal Articles and Magazines (2nd year).

#	Authors	Title	Journal / book information
1.	Dario Bega, Albert Banchs, Marco Gramaglia, Marco Fiore, Ramon Perez, Xavier Costa-Perez	AI-based Autonomous Control, Management, and Orchestration in 5G: from Standards to Algorithms	IEEE Network
2.	D. Bega, M. Gramaglia, A. Garcia-Saavedra, M. Fiore, and A. Banchs	Network Slicing Meets Artificial Intelligence: an AI-based Framework for Slice Management	IEEE Communications Magazine

3.	M. Fuentes, et. al.	5G New Radio Evaluation Against IMT-2020 Key Performance Indicators	IEEE Access
4.	G. Garcia, C. Donato, M. Gramaglia, P. Serrano, and A. Banchs	ACHO: A Framework for Flexible Re-Orchestration of Virtual Network Functions	Elsevier Computer Networks
5.	Roman Odarchenko, Yaroslav Horban, Oleksandr Volkov, Mykola Komar, Dmytro Voloshenyuk	Development of a system for registration and monitoring of UAVs using 5G cellular networks	Lecture Notes on Data Engineering and Communications Technologies
6.	David Gomez-Barquero, Jordi J. Gimenez and Roland Beutler	3GPP Enhancements for Television Services: LTE - Based 5G Terrestrial Broadcast	Wiley Online Library
7.	Albert Banchs, Gustavo de Veciana, Vincenzo Sciancalepore and Xavier Costa-Perez	Resource Allocation for Network Slicing in Mobile Networks	IEEE Access
8.	J.A. Ayala Romero, Andres Garcia Saavedra, Marco Gramaglia, Xavier Costa Perez, Albert Banchs, Juan José Alcaraz	vrAIn: Deep Learning based Orchestration for Computing and Radio Resources in vRANs	IEEE Transactions on Mobile Computing

6.2 Conference papers

5G-TOURS partners have published up to 5 conference papers during the first year and 7 papers during the second year. All the conference papers were added to the OpenAire repository and are also available on our public website (http://5gTOURS.eu/conference-papers/). The full list of conference papers, either published or accepted, are listed below. The joint work between partners is also highlighted.

Table 10. Conference papers (2nd year).

#	Authors	Title	Conference information
1.	Cristina Marquez, Marco Gramaglia, Marco Fiore, Albert Banchs, and Zbigniew Smoreda	Identifying Common Periodicities in Mobile Service Demands with Spectral Analysis	IEEE MedComNet
2.	M. Gramaglia, P. serrano, A. Banchs, G. Garcia-Aviles, A. Garcia-Saavedra and R. Perez	The case for serverless mobile networking	IFIP Networking
3.	M. Gramaglia, V. Sciancalepore. F.J. Fernandez-Maestro, R. Perez, P. Serrano, and A. Banchs	Experimenting with SRv6: a Tunneling Protocol supporting Network Slicing in 5G and beyond	IEEE CAMAD
4.	Luca Vignaroli, Marco Gramaglia, Manuel Fuentes, Antonino Casella, Roman Odarchenko, Lorenzo Natale, Baruch Altman and Francesco D'Andria	The Touristic Sector in the 5G Technology Era: The 5G-TOURS Project Approach	IEEE Globecom Workshop

5.	Juan Vargas (IMT Atlantique & Enensys Technologies, France); Cédric Thienot and Christophe Burdinat (Enensys Technologies, France); Xavier Lagrange (IMT Atlantique & IRISA, Université Bretagne Loire, France)	Broadcast-Multicast Single Frequency Network versus Unicast in Cellular Systems	WiMob 2020
6.	Roman Odarchenko,Anastasiia Abakumova,Serhii Bondar,Yuri Bogachuk	Advanced method for QoE evaluation and improvement in modern cellular networks	2020 *IEEE* International Scientific-Practical Conference "Problems of Info-communications. Science and Technology"
7.	Álvaro Ibáñez, Manuel Fuentes, Borja Iñesta, David Gomez-Barquero, Diarmuid Collins and Joao Santos	Single Frequency Networks for 5G Broadcast: a Software Defined Radio Experiment	IEEE BMSB 2020

6.3 Presentations, keynote speeches, invited talks

The main results of 5G-TOURS project have been presented in 18 talks and presentations during the first year and 22 during the second year.

Table 11. Presentations, keynote speeches, invited talks (2nd year).

	Main Author	Title	Event	Date	Place	Type of Audience
1	Velissarios Gezerlis, Tilemachos Doukoglou	5G-Event - 5th Generation Network Applications in Transport and Tourism	5G Event in Stavros Niarchos	18/10/2019	Athens	Industry/Academia
2	Marco Gramaglia	Overview of UC3M and 5G TOURS research activities	2020 CILAM Summer School	23/07/2020	Online	PhD students and researchers
3	Belkacem Mouhouche	Use case implementation of 5G Vertical Industries: Touristic, Safe and Mobility cities case study.	5G Summit	02/02/2020	Kuwait city	Industry/Academia
4	Belkacem Mouhouche	5G use cases implementation, the bridge between technology and verticals.	IEEE ICIOT Conference	04/02/2020	Doha	Industry/Academia
5	Fons de Lange	20201001 Connect Summer school event of the EU	Connect Summer School	01/10/2020	Online	Industry/Academia
6	Roman Odarchenko	Application of 5G networks for vertical industries: 5G-TOURS approach	Applied systems and technologies in the information society 2020	30/09/2020	Online	Industry/Academia
7	Roman Odarchenko	5G use cases for vertical industries in touristic, safe and mobility-efficient cities: challenges and facilities	Problems of infocommunications. Science and technology PIC S&T'2020	6/10/2020	Kharkiv Ukraine / Online	Academia

8	Lorenzo Natale	AI in Machines: The impact of intelligent robots on humanity with 2020 vision	Artificial Intelligence Oktoberfest, 2020 MathWorks Research Summit	15/10/2020	Online	Industry/Academia
9	Belkacem Mouhouche	5G Vertical Industries: From Research to Use Cases Implementation	ISNCC 2020 conference	21/10/2020	Online	Industry/Academia
10	Panagiotis Demestichas	Converting 5G Research and Development to Business Value	22nd Infocom world conference	6/11/2020	Online	Technical/Industry
11	Tilemachos Doukoglou	Application of two-way active measurements for 5G-network monitoring (a 5G-TOURS project innovation)	22nd Infocom world conference	6/11/2020	Online	Industry/Academia
12	Velissarios Gezerlis	Greek site infrastructure for the needs of 5G-EVE and 5G-TOURS European projects	22nd Infocom World Conference	6/11/2020	Online	Industry/Academia
13	Christophe Burdinat	Webinar: Making a case for DVB-MABR	DVB - Webinar	10/07/2020	Online	Industry/Academia
14	Francesco D'Andrià	XR application in 5GTOURS & 5GTOURS pilots: Palazzo Madama, Turin	Atos Innovation Week	5/06/2020	Online	Industry
15	Pavlos Koulouris	Using the power of 5G to deliver quality digital learning experiences outside the classroom	European Distance and E-Learning Network - EDEN Open Classroom Conference 2020 "Open and Distance Education: New Challenges and Perspectives"	8 November 2020	Athens, Greece / Online	School communities/Academia
16	David Gómez-Barquero	5G-TOURS presentation	Gandia city Council	4/02/2020	Gandia (Valencia)	School communities/Academia
17	David Gómez-Barquero	5G-TOURS presentation	Gandia EPSG	3/03/2020	Gandia (Valencia)	School communities/Academia
18	Roman Odarchenko	Most challenging 5G use cases	The night of science	11/11/2020	Online	Industry/Academia
19	Jordi Hernández & Enrique Quirós	Providing tourists with enhanced interactive experience based on XR technology	Digital Show 2020, ARI	24/11/2020	Online	Industry
20	IIT and Ericsson	IIT presented the integration of 5G technology on the R1 robot as a virtual booth.	I-RIM 3D EXPO 2020 as part of the 2020 Rome Make Faire	12/12/2020	Online	Industry/Academia/General public
21	Marco Gramaglia	The Touristic Sector in the 5G Technology Era	IEEE Globecom	9/12/2020	Online	Industry/Academia

| 22 | Marco Gramaglia | Machine Learning for Network Automation: Some ideas on the topic | ITU-T focus group on autonomous networks (FG-AN) | 4/02/2021 | Online | Industry/Academia |

6.4 Scientific workshop

5G-TOURS partners have submitted the scientific workshop proposal to IEEE Global Communications Conference (GLOBECOM), which is one of the IEEE Communications Society's two flagship conferences dedicated to driving innovation in nearly every aspect of communications [https://globecom2020.ieee-globecom.org/about]. In 2020, more than 3000 scientific researchers and their management submitted proposals for program sessions that were held at the annual conference. 5G-TOURS workshop call for papers is available: http://5gTOURS.eu/call-for-workshop-papers/.

Due to the current pandemic, IEEE GLOBECOM 2020 was held as a hybrid conference allowing registrants the choice to participate virtually or in-person in Taipei. The conference took place on 7-11 December 2020.

Our 5G-TOURS project workshop on IEEE Globecom 2020 conference "Early deployments of 5G networks features and performance" became a part of "IEEE GLOBECOM 2020 Workshop on Advanced Technology for 5G Plus (AT5G+)". This workshop was successfully held on 11 December 2020. This full-day workshop provided the opportunity for attendees from both academia and industry to share the views on advanced technologies towards 5G+. During the workshop were presented 20 papers. 5G-TOURS persons served as co-chairs of the workshop and TPC members.

Within the framework of this workshop, Marco Gramaglia presented the paper "The Touristic Sector in the 5G Technology Era: The 5G-TOURS Project Approach" on the IEEE Globecom Virtual Conference Platform. The paper discusses the challenges and the solutions that have been put in place in the Touristic City to provide the envisioned use cases about smart tourism and robotics. The video of presentation is available: http://5gTOURS.eu/joint-workshop-on-ieee-globecom-2020/ and the paper is available: http://5gTOURS.eu/conference-papers/.

6.5 Industrial workshops

5G-TOURS consortium involves a number of partners whose activity has a strong social emphasis, such as a hospital, a school, a museum, a municipality, an airport and a security agency. Driven by these actors, many of the use cases addressed by the project have a strong societal impact. In order to assess the resulting benefits for society, 5G-TOURS will conduct the subjective evaluation which will be fed with the feedback received from the verticals participating in the project workshops.

Thus, 5G-TOURS is planning to implement a comprehensive dissemination strategy towards the verticals with the organisation of industrial workshops. This dissemination strategy is of prime importance to let project's results and findings percolate among industrial stakeholders.

Also, the project will further organise three industrial workshops devoting particular efforts to reach vertical industries outside the consortium and make them aware of the advantages that 5G can potentially bring to their businesses. These workshops are planned to be organised in the end of 2021 in three cities: Turin, Rennes and Athens.

Through this series of workshops, each focusing on a specific study node, project partners aim to investigate how 5G technology & architectures are aligned with creating stakeholder value within the industry verticals and how they might contribute to the long-term goals of an enterprise by creating superior performance, complimenting internal resources, and exploiting external opportunities.

The aim of these workshops will be to gather technology stakeholders and vertical industries beyond those in the 5G-TOURS consortium and communicate to them the project concept and results in a direct and effective way. A strong emphasis will be given to the use cases demonstrations, to show the advantages and benefits of 5G technology to address real problems and provide practical solutions.

Currently the WP4/5/6 leaders, UC owners and other responsible persons are working on the description of the workshops, using the next form.

Table 12. Industrial workshop proposal template.

Title of the workshop:	
Responsible person(s): **E-mail(s):**	
Date:	
Host organisation/location in Athens	
Workshop Organizers (names, affiliation and contact information):	
Names of potential participants, such as program committee members and invited speakers:	Should include someone from the 5G-TOURS Team able to present & answer questions relating to the business case economics & business modeling associated with the Athens trial. Please include the list of vertical users, that can participate
Planned format of the workshop, including:	The "format" should include a Electronic Questionnaire issued to the business case economics & business modeling focused attendees. This will be a modified version of the internal Questionnaire circulated to the 5G-TOURS partners.
Brief description of the workshop idea (issues covered, format of workshop etc.)	
Duration of the workshop: Half-day,Full-day	Half-day / Full-day
Hot topic sessions, keynotes, panels (and panel formats) etc.	

6.6 Website and social media

So far, the main dissemination activities have been shared via the project website and twitter. In order to ensure the largest possible exposure of the project, other social media and networking tools have also been activated.

A public website (http://5gTOURS.eu/) presents the news, events, description, consortium and public deliverables of the project. The public website is the central hub for the dissemination activities. 5G-TOURS website is reachable via 5G PPP projects page https://5g-ppp.eu/5g-TOURS/. Open access to scientific publications is being ensured by publishing submitted papers in compliance with IEEE rules.

The following figure shows as an example part of the publication section, where blog posts of the partners are shared.
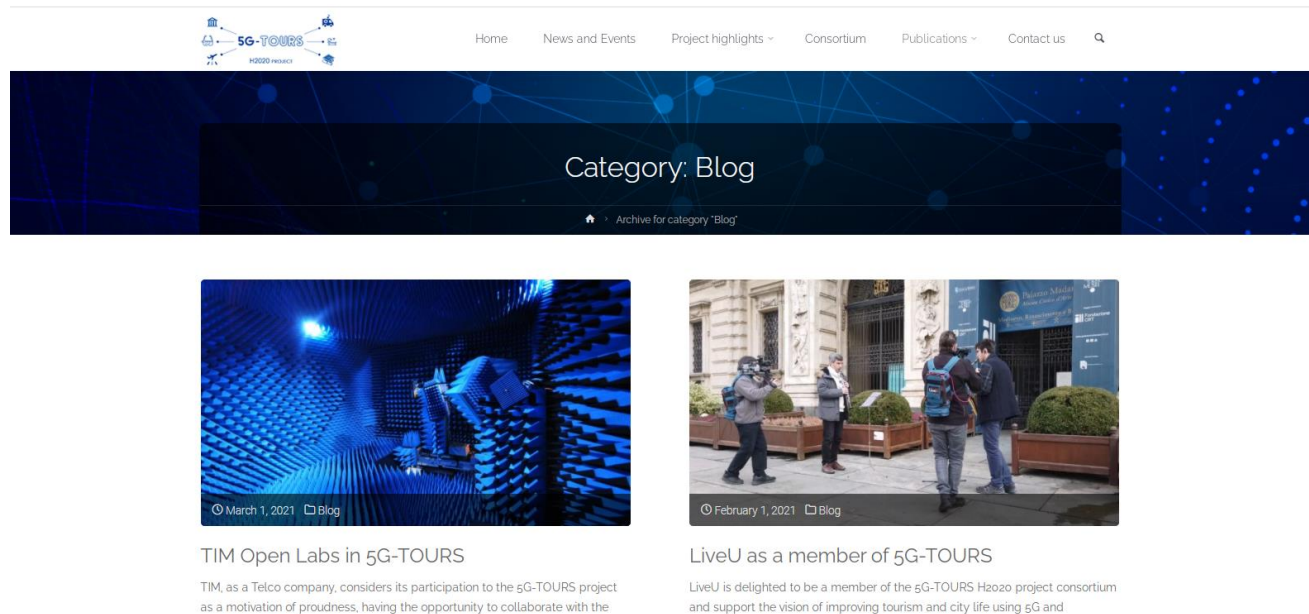
Figure 13. Official website of 5G-TOURS project (blog posts).

Website visits analysis using Google Analytics tool is shown on the following figure:
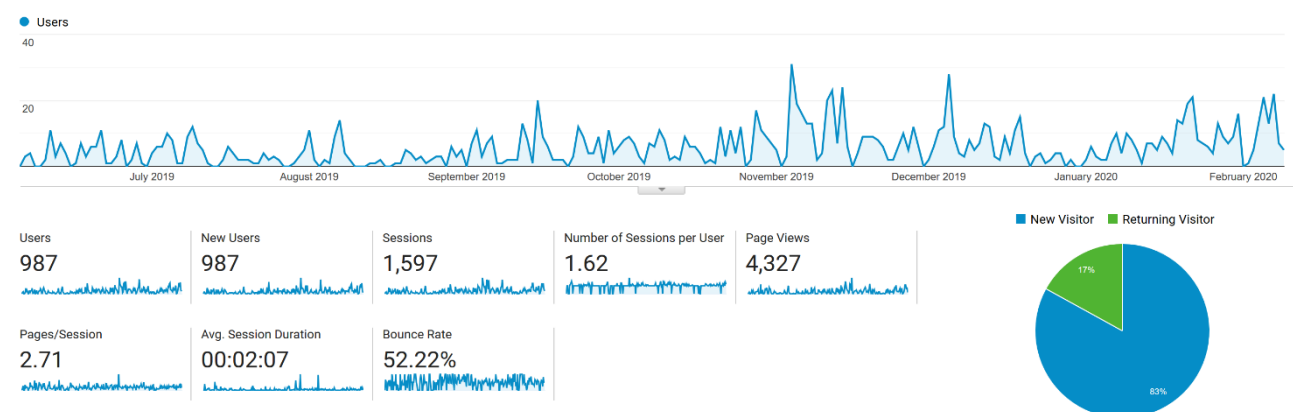
Figure 14. Website visits analysis.

Currently, the website contains the following pages:

- **Home:** General information about the project;

- **News and events:** Information regarding the last news and future events;

- **Project highlights:** This page consists of three subpages "Objectives", "Approach" and "Architecture";

- **Consortium:** Information about project partners;

- **Publications:** This page contains the following subpages: "Blog", "Deliverables", "Dissemination materials", "Videos" and constantly updated, in accordance with the progress in publishing activity, video production, preparation of presentation materials, etc;

- **Contact us**: Feedback form for the website visitors.

    - **Blog:** Blog posts are planned to be published according to the developed plan;

    - **Dissemination materials (press releases, brochure, project presentation):** These materials will be posted (up-dated) as they are produced;

    - **Newsletters:** Newsletter issues will be periodically published on the website and social media, also emailed to stakeholders (a contact list to be updated on a regular basis).

The project is using Twitter (https://twitter.com/5gTOURS) as a key tool for dissemination. Not only news related to the project or published in the website, but also the main activities related to 5G-PPP or 3GPP are continuously shared through this platform. Currently, the project has shared 116 tweets reaching more than 1200 impressions in total. This impact has led our Twitter account to have 359 followers and more than 1600 profile visits. The current number of tweets, followers and links on twitter are also observed in Figure 20.

LinkedIn is another social media tool used to promote the 5G-TOURS work. The release of new project deliverables, news articles related to project meetings and the participation in 5G-PPP or other events are continuously shared through this platform. 5G-TOURS is present on Linkedin under the name of '5G-TOURS' (https://www.linkedin.com/company/30118784). 5G-TOURS profile visitors come from different professional sectors, showing the project impact on different fields. 5G-TOURS LinkedIn profile page is shown in Figure 21.

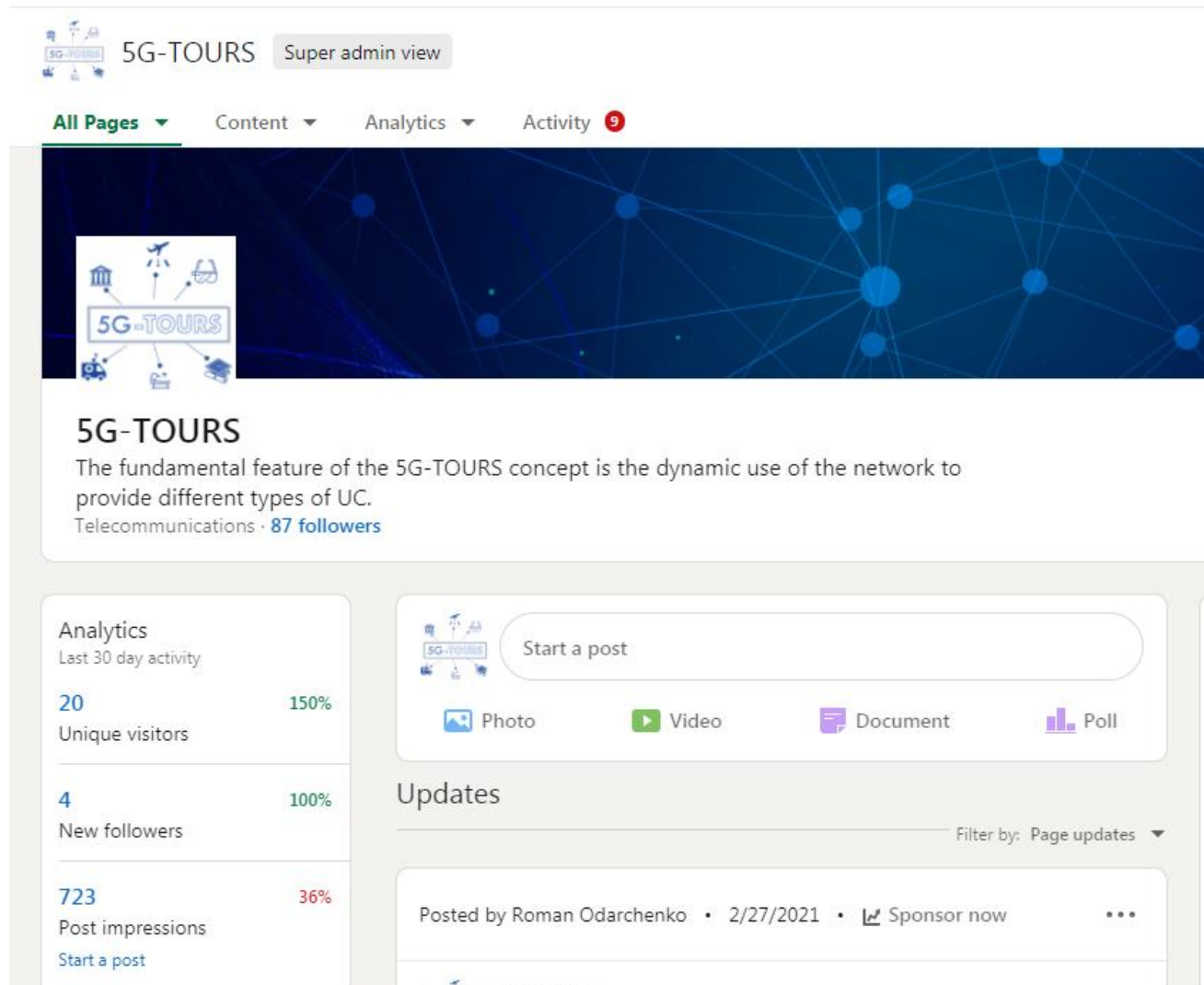**Figure 15. Official 5G-TOURS twitter account.**

Figure 16. LinkedIn profile.

A YouTube channel has been created and already has captured several presentations from demonstrations, workshops, webinars and test-bed trials. The following figure presents the updated project profile.
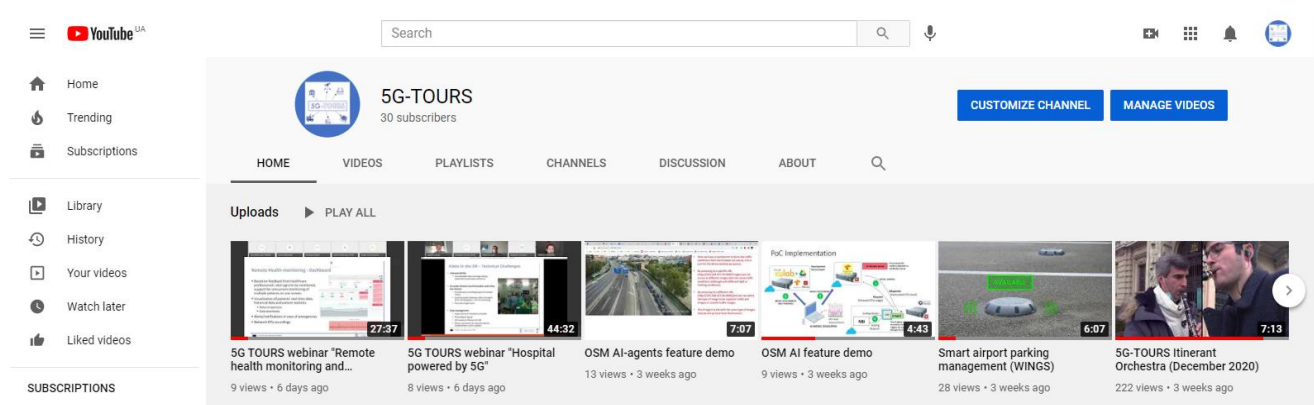

Figure 17. 5G-TOURS profile on YouTube.

Some channel statistics you can find in Figure 17.
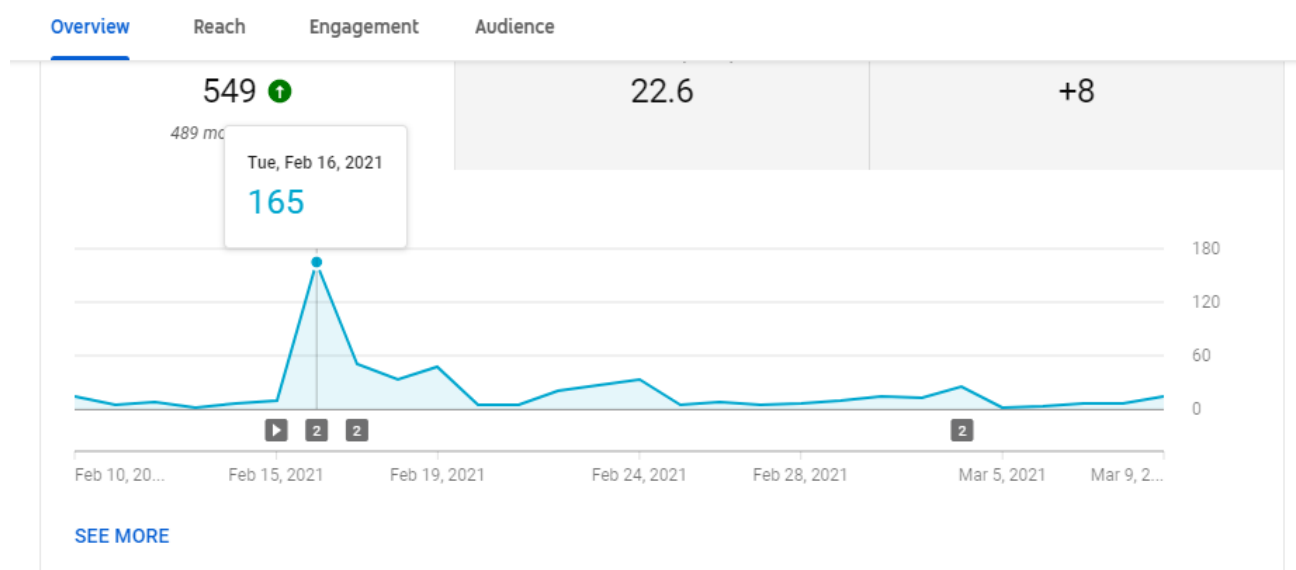
Figure 18. 5G-TOURS YouTube channel statistics.

16 videos were already published on the official website and YouTube channel (Table 13).

Table 13. List of published videos.

#	Title	Brief description
1	5G-TOURS Cartoon	This cartoon video shows the European 5G Vision of "5G empowering vertical industries" closer to commercial deployment with 13 highly innovative use cases involving citizens and tourists in 3 types of cities.
2	Webinar 1	This webinar is a part of "5G end to end experimentation by verticals in EU projects".
3	Webinar 2	Webinar is about the use of broadcast and multicast technologies in 5G, integration and application to use case 4 in 5G-TOURS.
4	Webinar 3	A webinar is focused on the technology that is powering immersive experiences on several 5G-TOURS use cases.
5	vrAIn: A deep learning approach tailoring computing and radio resources in virtualized RANs	While the application of the NFV paradigm into the network is proceeding full steam ahead, there is still one last milestone to be achieved in this context: the virtualization of the radio access network (vRAN). Due to the very complex dependency between the radio conditions and the computing resources needed to provide the baseband processing functionality, attaining an efficient resource control is particularly challenging. In this demonstration, we will showcase vrAIn, a vRAN dynamic resource controller that employs deep reinforcement learning to perform resource assignment decisions. vrAIn, which is implemented using an open-source LTE stack over a Linux platform, can achieve substantial savings in the used CPU resources while maintaining the target QoS for the attached terminals and maximize throughput when there is a deficit of computational capacity.
6	Practical 5G Healthcare use cases	This is a video from Connect University about the Practical 5G Healthcare use cases in the 5G-TOURS project.

#	Title	Brief description
	in the 5G-TOURS project	
7	Joint 5G EVE – 5G-TOURS Demo Webinar	Collaboration between 5G EVE and 5G-TOURS – Belkacem Mouhouche, Samsung (Technical Manager of 5G-TOURS) • Demo 1: Smart parking in Athens International Airport – Evangelos Kosmatos, WINGS • Demo 2: Augmented tourism experience – Enrique Quirós, Atos • Demo 3: Teleguidance for diagnostics and intervention support – Ian Hay, Orange • Wrap-up – Mauro Boldi, TIM
8	Robot-assisted museum guide Integration over 5G	5G Network enables Robotic Remote control through complex environments supporting autonomous navigation. Ericsson Italy and Istituto Italiano di Tecnologia, IIT, are developing and integrating this application in the Laboratories of Genoa in the context of the H2020 5G TOURS project. The result of these activities will enable this application, with IIT R1 Robot, to be implemented in Turin site inside the Palazzo Madama and GAM Museums which will be equipped with Ericsson technologies for 5G Network implementation.
9	Augmented reality use case (WP 4 UC1)	WP4.A-AR: An augmented reality app to improve the experience of the visitors of the Palazzo Madama. The app makes use of Beacons to improve indoor location and also connects to Smart City Services to give the visitors useful and updated information. The 5G network allows real-time access to all the high-quality media content.
10	5G TOURS Remote Health monitoring (UC6) and Optimal Ambulance routing (UC9) (WINGS)	Remote Health monitoring and Emergency situation notification (UC6) addresses solutions for remote health monitoring of people, especially when already diagnosed with a critical disease still compatible with home care (e.g. some form of cardiovascular disease, hypertension, diabetes, etc.). The main features offered, utilising the WINGS STARLIT platform, include: (a) real time remote health monitoring services of main vital-signs, and (b) quick, reliable notifications to users, family members and health care professionals in case of a health incident or a health emergency prediction. Optimal ambulance routing (UC9) addresses real time navigation of the ambulance, both to the site of the emergency and back to the hospital, to ensure the timely provision of medical help and immediate patient transfer. While optimal ambulance routing has been addressed extensively from a a more theoretical aspect, the emergence of technologies such as 5G actually enables the fast and reliable acquisition of data on changing factors of an urban or suburban environment such as traffic flow, changing road graph, population mobility, and hospital capabilities, to be exploited by AI powered decision making.
11	5G-TOURS Itinerant Orchestra demo video	Remote and distributed video production is one of the most exciting and challenging of 5G use cases. As a much more efficient method of producing live sports, news, entertainment and events coverage than traditional outside broadcasts, it will allow broadcasters to deploy fewer camera operators to events (although many more cameras) and staff to work on multiple events a day, being located in a centralized studio. This use case is designed to get an inside track on some of the multi-camera remote production capabilities, challenges and possibilities to come during the very early phases of 5G deployment. the main objective of the use case is to exploit the 5G TOURS network features for remote television production, analyzing how 5G networks could support various scenarios in which high-quality video is generated and transmitted.

#	Title	Brief description
12	Smart airport parking management (WINGS)	Smart airport parking management (UC10), onboarding on 5G EVE platform and AI-based enhanced MANO operation (WINGS)
13	OSM AI feature demo	Scaling action based on VNF CPU level forecasting
14	OSM AI-agents feature demo	VNF scaling actions based on road traffic image recognition
15	5G TOURS webinar "Remote health monitoring and emergency services powered by 5G"	A webinar about Remote Health Monitoring and emergency services powered by 5G. The webinar will showcase solutions for remote health monitoring of people, especially when already diagnosed with a critical disease still compatible with home care (e.g. some form of cardiovascular disease, hypertension, diabetes, etc.). The main features offered, utilising the WINGS STARLIT platform, include: (a) real time remote health monitoring services of main vital-signs, and (b) quick, reliable notifications to users, family members and health care professionals in case of a health incident or a health emergency prediction. The Webinar will also shortly showcase how, when an emergency has been identified, optimal ambulance routing is triggered to navigate the ambulance through areas with 5G coverage to ensure the provision of medical help on the go as well as timely patient transfer.
16	5G TOURS webinar "Hospital powered by 5G"	A webinar about the usage of the 5G inside the hospital. From the standardisations topics related to both 5G and DICOM, webinar will then go through the explanation of the UC8 architecture and features of 5G TOURS Project, showing also related KPI and metrics.

6.7 Webinars

Because of COVID-19, it was decided to use webinars as one of the dissemination channels. Interested consortium members have already organized their webinars:

Table 14. Webinars.

#	Event title	Event date	Leading partner(s)	Description
1	AI for radio network orchestration (tenative)	9th June 2020	UC3M	A webinar about the usage of AI for radio network orchestration. Included in a joint H2020 project effort
2	The role of broadcast and multicast in 5G-TOURS: High-quality video services distribution	25th June 2020	UPV	Webinar about the use of broadcast and multicast technologies in 5G. Integration and application to use case 4 in 5G-TOURS.
3	Multidevice XR experiences. WebXR + 5G	25th June 2020	SRUK	A webinar focused on the technology that is powering Immersive experiences on several 5G TOURS use cases.

#	Event title	Event date	Leading partner(s)	Description
4	Hospital powered by 5G	4th March 2021	BCOM	A webinar about the usage of the 5G inside the hospital. From the standardisations topics related to both 5G and DICOM, webinar will then go through the explanation of the UC8 architecture and features of 5G TOURS Project, showing also related KPI and metrics
5	Remote health monitoring and emergency services powered by 5G	4th March 2021	WINGS	A webinar about Remote Health Monitoring and emergency services powered by 5G. The webinar will showcase solutions for remote health monitoring of people, especially when already diagnosed with a critical disease still compatible with home care (e.g. some form of cardiovascular disease, hypertension, diabetes, etc.). The main features offered, utilising the WINGS STARLIT platform, include: (a) real time remote health monitoring services of main vital-signs, and (b) quick, reliable notifications to users, family members and health care professionals in case of a health incident or a health emergency prediction. The Webinar will also shortly showcase how, when an emergency has been identified, optimal ambulance routing is triggered to navigate the ambulance through areas with 5G covage to ensure the provision of medical help on the go as well as timely patient transfer.
6	Smart Parking management powered by 5G - maybe ad another use case from the Athens node (e.g UC13 or UC12) - exact title pending	December 2020	WINGS	A webinar focused on the use cases that will be deployed on AIA.
7	5G-EVE and 5G-TOURS joint event	3rd December 2020	Samsung, ATOS, WINGS, Orange, TIM	Collaboration between 5G EVE and 5G-TOURS – Belkacem Mouhouche, Samsung (Technical Manager of 5G-TOURS) • Demo 1: Smart parking in Athens International Airport – Evangelos Kosmatos, WINGS • Demo 2: Augmented tourism experience – Enrique Quirós, Atos • Demo 3: Teleguidance for diagnostics and intervention support – Ian Hay, Orange Wrap-up – Mauro Boldi, TIM

After each event, a report was published on social media and the website.

6.8 PRs and industry articles

For the current moment partners have already published several PRs, which achieved a very high exposure. These PRs are represented below.

Table 15. Press releases.

#	Partner	Issue date	Publication	Link
1	UPV	November 2019	Agencia EFE	https://www.efe.com/efe/comunitat-valenciana/sociedad/la-upv-referente-internacional-en-aplicar-5g-television-del-futuro/50000880-4117627
2	UPV	November 2019	UPV News	http://www.upv.es/noticias-upv/noticia-11642-5g-TOURS-es.html
3	Fondazione Torino Musei	March 2020	Corriere Torino	2020.03.01_Corriere_5GTOURSPaM.pdf
4	UPV	April 2020	Linkedin	https://www.linkedin.com/pulse/la-universidad-debe-estar-en-vanguardia-de-5g-para-va-gomez-barquero/?trackingId=RAPzwv2BR22oUdi7WKTDxw%3D%3D
5	Atos	May 2020	Atos website	https://atos.net/it/2020/comunicati-stampa_2020_05_07/atos-offrira-ai-visitatori-del-museo-palazzo-madama-di-torino-unesperienza-interattiva-avanzata-su-tecnologia-xr
6	LiveU	July 2020	Web page and social media	https://5gTOURS.eu/first-5g-TOURS-remote-television-production-tests-over-the-5g-network/

Also, project partners have already published the next list of industrial articles.

Table 16. Industrial articles.

#	Partner	Issue date	Publication	Link
1	LiveU	Oct 2020	at TM Broadcast International #86, pg 54, "What 5G means for media and entertainment", Baruch Altman	https://issuu.com/daromedia/docs/tmbroadcastinternational86?fr=sOWE0YjM2ODg0OQ
2	LiveU	Sept 2020	LiveU at IABM Journal 3rd quarter 2020 #114 (The International Trade Association for the Broadcast & Media Industry): 5G for media and entertainment: from theory to practical use cases, Baruch Altman	https://theiabm.org/wp-content/uploads/2020/09/Journal-114-2020-web-version.pdf
3	LiveU	Jul 2020	LiveU at Mediakwest, online and printed (Jun-Jul magazine), in French	https://mediakwest.com/rencontre-avec-baruch-altman-liveu-a-loree-de-la-vague-5g/

#	Partner	Issue date	Publication	Link
4	LiveU	February 2020	TM BROADCAST MAGA-ZINE #78, February 2020 , ISSN: 2659-5966 , Pg. 8 "News Success Stories".	https://issuu.com/daromedia/docs/tmbroad-castinterna-tional78?fr=sZjA1MTM2ODg0OQ
5	EA	November 2020	Interview in the VRWORLDTECH magazine (www.vrworldtech.com)	https://issuu.com/vrworldtechmaga-zine/docs/vrworldtech_magazine_5/42

6.9 Newsletter

In November 2020 5G-TOURS issued the first Newsletter, which was distributed among more than 200 institutions from academia, industry, verticals, etc. 5G-TOURS project achievements, innovation stories, and relevant events were highlighted in the first issue.

This first edition were focused on 6 of 13 innovative use cases. The first page of newsletter is presented below on Figure 24 and the full newsletter is also available on the official website: http://5gTOURS.eu/510-2/.

Figure 19. 5G-TOURS Newsletter.

7 Conclusion

The second year of 5G- TOURS is well on course to secure the objectives of the project with respect to innovation and dissemination, despite the challenges of COVID-19 that have impeded progress of the project for over 12 months. Business Validation analysis has led to the refinement of the stakeholder engagements and developments such as the 5G Enterprise Pathfinder Framework taking into account the innovation values of the verticals as well as defining a analysis process to determine a network deployment approach. The cost analysis direction is now refined and will be developed in the coming months. Close interactions with WP2 by way of the socio-economic analysis framework have enabled the pathfinding of the appropriate way in which to tie the economic benefit and cost perspectives into a coherent business case analysis approach for the City deployments.

Each 5G-TOURS partner has reported ongoing activities regarding the exploitation of the project results. The refinement of the innovation focus in year two has guided a revision of exploitation plans where appropriate. This provides evidence of the closing of the loop from the Technology deployment and demonstration and the anticipation of exploitation. The third year will see a continued improvement of the approach to analysis and promotion of innovations.

Having established the customized innovation frameworks for the each of the verticals in year 1, year 2 sees the Innovation Managers supporting the refinement of innovation descriptions and whilst working closely with the WP2 (Economic benefit) and WP8 (Business Validation) perspectives as well as helping to increase promotion of the project to the vertical sectors.

After delivering 48 standards contributions in year1 – well ahead of target. 5G-TOURS has worked not only on quantity of contributions but also on refining the understanding of the quality of the contribution in terms of its impact in the standard and its linkage to particular use cases. There was increased effort on diversification of the standards bodies that 5G-TOURS contributed to. This effort has yielded significant impact into both the Health and Broadcast sectors, as well as the open source software community and activities such as ETSI ENI where testbeds bring benefits to the wider 5G ecosystem. Partners are now declaring a number of patents that emanate from the scope of the work in 5G-TOURS. The number of standards contributions in year two is 39.

The number of dissemination activities related to international journals and conference papers has reached 25 contributions. Regarding the number of keynotes and panels together with the participation in 5G events. The number achieved in year two of the project is 22.

COVID-19 has significantly impacted flagship events such as MWC and EuCNC in 2020, and this looks to continue to be the case well into 2021. Nevertheless, the number of conference papers and presentations continued to increase in year two. Ecosystem engagement methods such as webinars and increased content creation on the website through blogs have continued to show increased levels of engagement and will remain amongst some of the techniques that are maintained into year 3. All the targeted public deliverables were submitted on time and published in a timely fashion on the project website. These dissemination activities have helped to reach a large number of people from academia, industry, civil society, media, and perhaps may have performed as well and in some cases better than pre-COVID19 face to face conference.

The dissemination of project results has been challenged in recent months by the emergence of the COVID-19 virus. As 5G-TOURS progresses into the final year of activities there will be increased focus on planned workshops and gathering stakeholder data to validate the market claims of the project; the greatest opportunities for engagement and dissemination lay ahead for this project.

Acknowledgment

Acknowledgment

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Annex A, Contribution to standard

Num ber	Date	Source Partner	STD Body	Title	Reference	Status	Cate-gory
1-48				Part of D8.1			
49	25/05/2020 to 05/06/2020	SEQ	3GPP RAN1	Reduce Capability NR devices - 1st RAN1 meeting	SEQ tdoc: R1-2004176 3GPP summaries that include our contributions during e-meeting: R1-2004731, R1-2005048, R1-2005048, R1-2005114	SEQ contributed to NR RedCap study item regarding the design of reduced capability NR devices which is targeted to specify the first NR-based IoT-flavoured devices. SEQ generated one (1) document with views and proposals and also participated in discussions during the 2-week 3GPP e-meeting (+1 week post-meeting email discussion).	SI contribution
50	29/06/2020 to 03/07/2020	SEQ	3GPP RANP	Reduce Capability NR devices - RANP meeting	3GPP RedCap status report: RP-200821 3GPP Revised RedCap SID: RP-201386	SEQ contributed to 3GPP RANP email discussion [R17_RED-CAP_scope] for revising the RedCap study item description and objectives. SEQ helped to revise the scope of the objectives of the study, especially regarding the data rates requirements for high-end wearables use case.	WI update
51	17-28/08/2020	SEQ	3GPP RAN1	Reduce Capability NR devices - 2nd RAN1 meeting	SEQ tdocs: R1-2006682 (Complexity reduction techniques) R1-2006683 (Coverage recovery) R1-2006684 (Power consumption reduction) R1-2006686 (Framework and principles)	Contributed to NR RedCap study item. SEQ generated four (4) documents with views and proposals and also participated in discussions during the 2-week 3GPP e-meeting.	SI contribution

					3GPP summaries that include our contributions during e-meeting: R1-2007331 , R1-2007426, R1-2007312, R1-2007330		
52	10 Mar 2020	EXP - NN6 (Apple, Qulacomm)	3GPP SA4	Guidelines for HLS Media Presentation Delivery	S4-200232	Agreed	feature (3GPP -B)
53	10 Mar 2020	EXP - NN6 (Apple, Qualcomm Incorporated, Ericsson LM)	3GPP SA4	Support of HLS and hybrid DASH/HLS service over eMBMS	S4-200325	Agreed	feature (3GPP -B)
54	10 Mar 2020	EXP - NN6 (Apple, , Ericsson LM)	3GPP SA4	Support of hybrid HLS/DASH services	S4-200326	Agreed	feature (3GPP -B)
55	10 Mar 2020	EXP - NN6 (Qualcomm Incorporated)	3GPP SA4	Support of HLS and hybrid HLS/DASH services	S4-200329	Agreed	feature (3GPP -B)
56	10 Mar 2020	EXP - NN6	3GPP SA4	Triggering conditions for Consumption Reporting	S4-200331	Agreed	feature (3GPP -B)
57	09 Apr 2020	EXP - NN6	3GPP SA4	Consumption Reporting Procedure API- M1d and M5d	S4-200633	Agreed	feature (3GPP -C)
58	03 Jun 2020	EXP - NN6 (BBC, Tencent, Sony, Ericsson LM, Qualcomm Incorporated)	3GPP SA4	Consolidated changes from SA4#108-e et seq.	S4-200863	Agreed	Correction (3GPP -F)
59	03 Jun 2020	EXP - NN6 (BBC, Tencent, Sony, Ericsson LM, Qualcomm	3GPP SA4	Consolidated changes from SA4#108-e	S4-200882	Agreed	Correction (3GPP -F)

		Incorpo-rated)		and SA4#109-e			
60	03 Jun 2020	EXP - NN6 (Ericsson LM, BBC)	3GPP SA4	API for Service Access infor-mation ac-quisition (Stage 3)	S4-200889	Agreed	feature (3GPP -B)
61	03 Jun 2020	EXP - NN6	3GPP SA4	Consump-tion report-ing in M7d interface	S4-200920	Agreed	feature (3GPP -B)
62	27 Aug 2020	EXP - NN6 (BBC)	3GPP SA4	Update on consump-tion report-ing	S4-201225	Agreed	
63	Jan 2020	SRUK	3GPP SA2	23.288 CR0103: Clarifica-tion on def-initions and NSI	S2-2001153	Revised and ap-proved. Co-sourced with DO-COMO.	Cor-rection (3GPP -F)
64	Jan 2020	SRUK	3GPP SA2	23.700-91: Solution to support slice SLA guarantee.	S2-2000888	Revised and ap-proved	pCR
65	Feb 2020	SRUK	3GPP SA2	23.288: Slice ser-vice expe-rience data collection corrections	S2-2002454	Approved	Cor-rection (3GPP -F)
66	Feb 2020	SRUK	3GPP SA2	23.288: Corrections to UE mo-bility event notification	S2-2002455	Approved	Cor-rection (3GPP -F)
67	Feb 2020	SRUK	3GPP SA2	23.288: Updates to AMF event exposure and event filters	S2-2001867	Approved	Cor-rection (3GPP -F)
68	April 2020	SRUK	3GPP SA2	Miscella-neous FASMO corrections to service experience analytics	S2-2002746	Approved (Re-vised to S2-2003320)	Cor-rection (3GPP -F)
69	April 2020	SRUK	3GPP SA2	NWDAF service de-scriptions corrections	S2-2002747	Approved (Merged/Revised to S2-2003339)	Cor-rection (3GPP -F)
70	April 2020	SRUK	3GPP SA2	Updated Event IDs	S2-2003042	Approved (Re-vised to S2-2003338)	Cor-rection

				for analyt-ics			(3GPP -F)
71	April 2020	SRUK	3GPP SA2	NEF event exposure service cor-rections	S2-2003187	Approved	Cor-rection (3GPP -F)
72	April 2020	SRUK	3GPP SA2	AF event filter for service ex-perience area of in-terest	S2-2003184	Approved	Cor-rection (3GPP -F)
73	June 2020	SRUK	3GPP SA2	Corrections for maxi-mum num-ber of ob-jects and Maximum number of SUPIs	S2-2003867	Approved (revised to S2-2004328; co-sourced along NOK, Huawei)	Cor-rection (3GPP -F)
74	June 2020	SRUK	3GPP SA2	Updates to Sol#2 on support for slice SLA guarantee	S2-2003792	Approved (revised to S2-2004544)	pCR
75	June 2020	SRUK	3GPP SA2	Solution for unicast-multicast delivery mode switch	S2-2003791	Approved (revised to S2-2004507; co-sourced by Con-vida Wireless)	pCR
76	June 2020	SRUK	3GPP SA2	KI#1: up-date Annex A to clarify MBS archi-tecture al-ternatives .	S2-2003897	Approved (merged to S2-2003982; re-vised to S2-2004517; co-sourced along Ten-cent; drafted jointly with HQ)	pCR
77	June 2020	SRUK	3GPP SA2	Architec-ture option 2 update	S2-2004594	Approved (co-sourced along Er-icsson, ZTE)	pCR
78	Aug 2020	SRUK	3GPP SA2	Service ex-perience analytics discrimina-tion	S2-2005066	Approved (revised to S2-2006220); co-sourced by CATT, ETRI	Cor-rection (3GPP -F)
79	Aug 2020	SRUK	3GPP SA2	Location event filter for trusted AF	S2-2005760	Approved; co-sourced by Erics-son	Cor-rection (3GPP -F)
80	Aug 2020	SRUK	3GPP SA2	KI#4, Sol#2: Re-moval of ENs on slice load analytics	S2-2005469	Approved (revised to S2-2006250); co-sourced by NTT DOCOMO, CATT	pCR
81	Aug 2020	SRUK	3GPP SA2	KI#10, New solu-tion on	S2-2005089	Approved (revised to S2-2006260); co-sourced by	pCR

				user plane optimiza-tion		LGE; based on SBPA submission	
82	Aug 2020	SRUK	3GPP SA2	Key Issue #4 solution evaluation and interim conclusion	S2-2005634	Approved (revised to S2-2006251); co-sourced by NTT DOCOMO	pCR
83	Aug 2020	SRUK	3GPP SA2	KI#7, Sol#24: Removal of ENs on unicast to multicast switch	S2-2005758	Approved (revised to S2-2006323)	pCR
84	Aug 2020	SRUK	3GPP SA2	KI#7, Sol#24: Updates in-troducing multicast to unicast switch	S2-2005106	Approved (revised to S2-2006322)	pCR
85	15/05/2020	BCOM	3GPP SA1#90	Correction of CMED KPIs tables	S1-202181	Approved	Cor-rection (3GPP -F)
86	15/05/2020	BCOM	3GPP SA1#90	Update de-scription for medical application in section 4.4	S1-202182	Approved	Cor-rection (3GPP -F)
87	15/05/2020	BCOM	3GPP SA1#90	Correction of service perfor-mance re-quirements in tables of annex A.6	S1-202183	Approved	Cor-rection (3GPP -F)
88	Feb 2020	SEQ	3GPP RAN2	Impact of CG-SPS with perio-dicities non dividing HF length	R2-2001627	Agreed (related to study item of NR_IIoT. SEQ proposed adding a TimeRef-erenceSFN param-eter for configured grant Type 1, and it was agreed by RAN2)	SI con-tribu-tion
89	Feb-May 2020	SEQ	3GPP RAN2	NB-IoT UE Specific DRX	SEQ technical tdocs: R2-2001629 - Options 1/2 and Fast Paging Escalation R2-2001630 - Effi-ciency Issues	The aspect of NB-IoT UE Specific DRX was brought by companies dis-cussed in RAN2 at a late stage dur-ing the Rel.16 NB-IoT enhancements work item.	SI contri-bution ?? (in-troduc-tion of

					Summary of discussions led by SEQ: R2-2003669 - Report of [Post109e#15][NBIOT] UE specific DRX: DRX cycle values R2-2005938 - Report of [AT110-e][315][NBIOT] CSS overlapping case for UE specific DRX R2-2006005 - Report of [Post109bis-e][944][NBIOT] CSS overlapping case for UE specific DRX	SEQ raised a lot of issues, helped on those issues with proposals (for example, positive outcome was the introduction of one SIB parameter SEQ initially proposed within our technical document) and actually led as rapporteur for 3 related discussions.	one SIB parameter that we proposed can be considered as feature?)
90	Aug 2020	SEQ RAN2	3GPP RAN2	Enhancement for support of time synchronization	R2-2007627	(Related to the work item of NR_IIoT_URLLC.) SEQ provided some views and suggestions to RAN2 regarding ▪ RAN impacts of SA2 work on uplink time synchronization for TSN ▪ Propagation delay compensation enhancements (including mobility issues) Nothing agreed at this meeting. See updated submission - item 106	WI update
91	Jan 2020	PRE	PCHA	PCHA released the 2019 version of the Continua Design Guidelines	Continua Design Guidelines	PRE contributed to the Continua Design Guidelines	Feature

92	April 2020	PRE	PCHA	The new IHE DEV Personal Connected Health (PCH) sub-domain produced and published the Personal Health Device Observation Upload (POU) Profile	POU	PRE contributed to the POU	Feature
93	June 2020	PRE	PCHA / IHE-DEV	New stand-alone simplified information model independent of the transport technology. Once released, ACOM will become the IEEE 11073-10206 standard	IEEE 11073-10206 standard. 4-min public introduction video	PRE made key contributions to the IEEE 11073 PHD Working Group's Abstract Information Content Model (ACOM)	Feature
94	Sep 2020	PRE	IHE-DEV	New IHE DEV Profile for Direct-to-Cloud-Constrained Devices that transports heath data according to IEEE 11073-10206 ACOM.	IHE_DEV_Profile_for Direct-to-Cloud-Constrained Devices	PRE contributed to the proposal to create a new IHE DEV Profile for Direct-to-Cloud-Constrained Devices	Feature
95	Oct 2020	SRUK	3GPP SA2	KI#7, Sol#24: Multiple updates to solution.	S2-2007194	Approved (revised to S2-2008104)	feature (3GPP -B)
96	Oct 2020	SRUK	3GPP SA2	Clarification on individual	S2-2007281	Approved (revised to S2-2008086)	feature (3GPP -B)

				delivery definition.			
97	Oct 2020	SRUK	3GPP SA2	KI#2, Sol#1: Completion of multicast service levels.	S2-2007285	Approved (revised to S2-2007938)	feature (3GPP-B)
98	Oct 2020	SRUK	3GPP SA2	KI#1: Sol#3: Evaluation and Conclusion on IGMP JOIN.	S2-2007266	Merged to S2-2007774, revised to S2-2007935, approved. Co-sourced by Ericsson, LGE	feature (3GPP-B)
99	Nov 2020	SRUK	3GPP SA2	KI#7: Evaluation and Conclusion of KI#7.	S2-2008109	Co-sourced along Huawei, ZTE, OPPO; approved	feature (3GPP-B)
100	Nov 2020	SRUK	3GPP SA2	KI#2 conclusion	S2-2008539	Approved	feature (3GPP-B)
101	Nov 2020	SRUK	3GPP SA2	KI#7, Sol#24: procedure updates and alignment with KI#1	S2-2008540	Approved	feature (3GPP-B)
102	Nov 2020	SRUK	3GPP SA2	KI#7 conclusion update	S2-2008920	Merged and approved (revised to S2-2009481)	feature (3GPP-B)
103	Nov 2020	SRUK	3GPP SA2	KI #1, Update to Evaluation and Conclusion on UE Join via UP	S2-2008520	Led by E//, also co-sourced by LGE; Postponed	feature (3GPP-B)
104	Feb 2021	SRUK	3GPP SA2	Service levels definitions	S2-2100392		feature (3GPP-B)
105	Jun 2020	SEQ	3GPP RAN2	Correction on reception type combination for eMTC	R2-2005591, R2-2005596, R2-2005602, R2-2005609	CRs together with ZTE and Sanechips. Correcting eMTC reception types in 36.302 from Rel-13 forward. This just reflects what is already specified in PHY spec. CRs agreed.	Correction (3GPP-F)

| 106 | Nov 2020 | SEQ | 3GPP RAN2 | Mobility aspects of time synchroniza-tion | R2-2010173 | Update of item 90.

SEQ provided views on mobility aspects.

We mainly demon-strated that no ad-ditional work is needed for mobil-ity part of specific observations/pro-posal in the tdoc.

Nothing agreed at this meeting. See updated submis-sion - item 107 | WI up-date |
| 107 | Feb 2021 | SEQ | 3GPP RAN2 | Mobility aspects of time syn-chroniza-tion | R2-2101490 | Resubmission of item 106.

It was discussed along with others contribu-tions. **Output of the meeting was in line with our proposals**:

Assumptions:

There is no UE clock drift issue to be addressed

• The source and target gNB are tightly synchro-nized to the same master clock within the budget and there is no need to opti-mize any-thing for HO.

Agreements

gPTP message in-terruption during mobility is not considered in the Rel-17 IIoT WI (i.e. no further | WI up-date |

						specification impact are considered)	
108	Feb 2021	EXP	3GPP SA4	Aggregated essential corrections from various change requests	S4-210323	S4-210012: Essential corrections to Consumption Reporting APIs S4-210038: Replacement client architecture figures S4-210232: Corrections on Procedures and APIs for Downlink and Uplink Streaming (Rel-16) S4-210241: Removal of editor's notes and handling of multiple AF instances	Correction (3GPP-F)
109	FEB 2021	EXP	3GPP SA4	pCR TR 26.802 - key issue on MABR support in 5GMS	S4-210079	This contribution provides relavent changes to document description and identified gaps to support MABR	feature (3GPP-B)
110	Nov 2020	EXP	3GPP SA4	Feature Request for 5G Broadcast	S4-201605	The following changes are applied • References to ETSI TS 103 720 and 3GPP TR 36 976 • Addition of MBMS feature code for LTE-based 5G Broadcast Base Receiver Addition of MBMS feature code for LTE-based 5G Broadcast Main Receiver	feature (3GPP-B)