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5G BLUEPRINT

Next generation connectivity for enhanced, safe & efficient transport & logistics

D8.3: Intermediate Dissemination, Standardization, Exploitation and Joint Activities Report

Version 2.0

Work package	WP8
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Deliverable lead	Martel
Version	2.0

Abstract

This deliverable describes the communication, dissemination, standardization, and exploitation activities, conducted in the first 18 months of the project (September 2020 – February 2022). It also outlines the impact creation and outreach-related activities planned for the remaining 18 months of the project.

Keywords: Dissemination, Communication, Exploitation, Standardization, Press, Outreach, Liaisons, Events, KPIs

Document Revision History

Version	Date	Description of change	List of contributor(s)
v0.1	07/12/2021	Table of contents	M.C.Campodonico, Klaudia dos Santos (Martel)
v0.2	14/02/2022	Merging Partners' Contributions	K. dos Santos (Martel)
v0.3	16/02/2022	Internal Review	Oliver Held (Roboauto) Karen Van Brussel (NxtPort)
v0.4	23/02/2022	Revision based on the reviewers' comments	M.C. Campodonico, K. Dos Santos (Martel)
v1.0	28/02/2022	Final version ready for submission	J. Marquez-Barja (imec), W. Vandenberghe (MIW)
V1.1	21/10/2022	Revision based on the reviewers' comments	Galileo Disperati, M.C. Campodonico (Martel), J. Marquez-Barja (imec)
V2.0	30/11/2022	Final version ready for submission	W. Vandenberghe (MIW)

Disclaimer

Project co-funded by the European Commission under H2020-ICT-2018-20		
Nature of the deliverable:	R	
Dissemination Level		
PU	Public, fully open, e.g., web	√
CI	Classified, information as referred to in Commission Decision 2001/844/EC	
CO	Confidential to 5G-Blueprint project and Commission Services	

* R: Document, report (excluding the periodic and final reports)
DEM: Demonstrator, pilot, prototype, plan designs
DEC: Websites, patents filing, press & media actions, videos, etc.
OTHER: Software, technical diagram, etc

EXECUTIVE SUMMARY

The document at hand, developed in the context of WP8, builds on deliverable D8.1 *5G-Blueprint Dissemination and Communication Plan*, the project's communication, dissemination, and community-building strategy that has been developed in Q1 of the project. The strategy has been followed by all project partners to maximize the impact of 5G-Blueprint and ensure that the following communication-related project objectives are met:

- Ensure 5G-Blueprint's broad visibility by spreading knowledge about project activities and its results.
- Reach, stimulate, and engage a critical mass of relevant stakeholders to ensure that the project results are effectively showcased, leading to widespread validation, improvement, and further adoption of the developed technologies and concepts.
- Facilitate exploitation of project outcomes and promote the development of innovative solutions based on the 5G-Blueprint technologies and architecture.
- Foster an impactful contribution to relevant standardization bodies.
- Ensure close coordination with the 5G PPP community and establish liaisons with relevant initiatives, such as 5GAA, 5G IA, etc.

The document at hand describes the communication, dissemination, and community-building activities conducted by the 5G-Blueprint consortium during M1-M18 of the project and outlines the planned activities for M19-M36, in addition to introducing bespoke standardization and exploitation plans developed by project partners.

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ABBREVIATIONS

5G AA	5G Automotive Association
5G IA	5G Industrial Association
5G PPP	5G Infrastructure Public Private Partnership
AB	Advisory Board
AECC	Automotive Edge Computing Consortium
AI	Artificial Intelligence
BDVA	Big Data Value Association
CAD	Connected and automated driving
CAM	Connected and Automated Mobility
CAPEX	Capital Expenditure
CAV	Connected and autonomous vehicles
CCAM	Cooperative, Connected and Automated Mobility
CNF	Containerized Network Functions
DMI	Dutch Mobility Innovation
DPO	Data Protection Officer
EC	European Commission
ECTS	European Credit Transfer System
ETA	Estimated Time of Arrival
GDPR	General Data Protection Regulation
GPU	Graphics Processing Unit
IoT	Internet of Things
iTLC	Intelligent Traffic Light Controllers
IP	Internet Protocol
iTLC	Instant Thin Layer Chromatography Medium
KPI	Key Performance Indicator
M	Month
MANO	Management and Orchestration
MEC	Multi-access Edge Computing
MIW	Ministry of Infrastructure and Water Management
MNO	Mobile Network Operator
MOOC	Massive Open Online Course
NFVI	Network Function Virtualization Infrastructure
NGI	Next Generation Internet
NGIoT	Next Generation Internet of Things
NIST	National Institute of Standards and Technology (USA)
NR	New Radio
OBU	On-board Units
OPEX	Operational Expenditures
ORD	Open Research Data
RAN	Radio Access Network
RAT	Radio Access Technology
RSU	Road Site Units
RTTI	Run-time Type Information
SAE	Society of Automotive Engineers
SEO	Search Engine Optimization
TC	Teleoperation Consortium
TCP	Transmission Control Protocol
TMC	Technical Management Committee
TO	Teleoperation

ToD	Teleoperated Driving
TOV-ratio	Teleoperated-to-vehicle ratio
TRL	Technological Readiness Level
V2V	Vehicle-to-vehicle
V2X	Vehicle-to-everything
VIM	Virtual Infrastructure Manager
VNF	Virtual Network Function
WG	Working Group
WP	Work Package

1 INTRODUCTION

1.1 Purpose of the document

The deliverable at hand has been prepared in the context of Work Package 8 (WP8) *Dissemination and external collaboration* to serve three main purposes:

- Report on the progress of the 5G-Blueprint Dissemination and Communication Plan, which has been developed and submitted to the European Commission in November 2020.
- Outline the amended communication, dissemination, and community-building strategy for M19-M36.
- Introduce standardization and exploitation plans developed by project partners.

1.2 Structure of the document

The sections of this deliverable are organized in the following manner: After the introductory **Section 1, Section 2** depicts communication and dissemination activities and tools used during the first half of the project (M1-M18) and presents the amended plan for the remainder of the project. **Section 3** describes standardization activities while **Section 4** focuses on the exploitation of project results. **Section 5** concludes the document.

2 COMMUNICATION AND DISSEMINATION

Communication and dissemination activities are central to the overall 5G-Blueprint effort. They are being closely monitored and coordinated to ensure an effective engagement of all targeted stakeholders, including those in the broader 5G and CAM ecosystems and related vertical domains. To raise awareness and maximize the impact of the project, a comprehensive communication and dissemination plan has been developed in Q1 of the project. Its execution began at the early project stages and will continue throughout its whole duration. A set of dedicated online and offline activities outlined below is being pursued to support the achievement of project objectives and ensure a broad promotion and effective showcasing of developed concepts, technologies, use cases, and project results. These activities are conducted under MARTEL's leadership and guidance with active contributions from all 5G-Blueprint partners.

2.1 Communication and dissemination activities M1-M18

2.1.1 Brand identity

5G-Blueprint brand identity (see Figure 1) consists of elements, such as logo, icons, color palette, and typography that have been created to provide a unified and consistent 'look and feel' across all outlets (electronic and printed visual media) and to visually distinguish 5G-Blueprint from other projects. To ensure that all partners follow this identity, a document with clear brand guidelines has been developed and shared internally, in addition to presentations and deliverable templates.

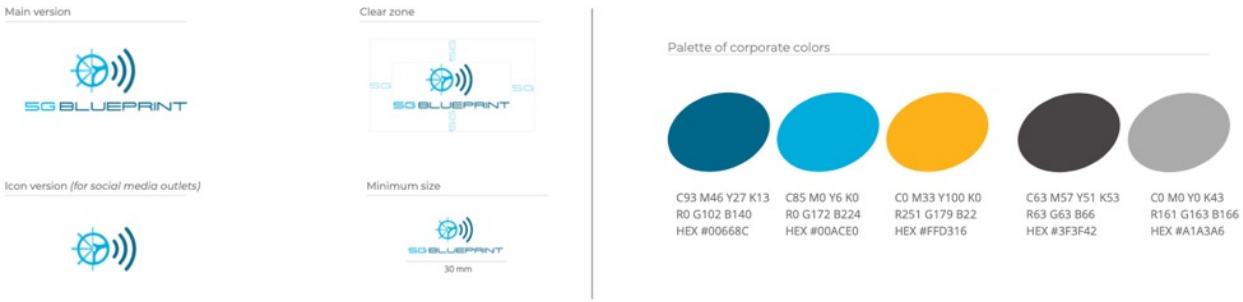

Figure 1: 5G-Blueprint brand guidelines

2.1.2 Project website

The 5G-Blueprint website www.5gblueprint.eu (see Figure 2), has been developed to act as an information hub presenting the project's goals, activities, and achievements. The website was launched in August 2020 before the official start of the project and features the following:

- General information about the project, its vision, objectives, and anticipated impact.
- Information about project use cases and enabling functions.
- A brief introduction to all members of the consortium.
- News items and press releases.
- List of relevant events.
- A repository of resources, such as scientific publications, presentations/talks, promotional materials, and public deliverables.
- Contact information.

- An acknowledgment and reference to the European Union's Horizon 2020 Framework Program funding and the 5G PPP.

Figure 2: 5G-Blueprint website

The website is being periodically updated according to the evolution of the project. Further updates will be applied as necessary throughout the whole duration of 5G-Blueprint. At the time of writing, the website counts 3.064 unique visitors, who generated 11.054 page views and an average visit duration of 2'13" as shown in Figure 3.

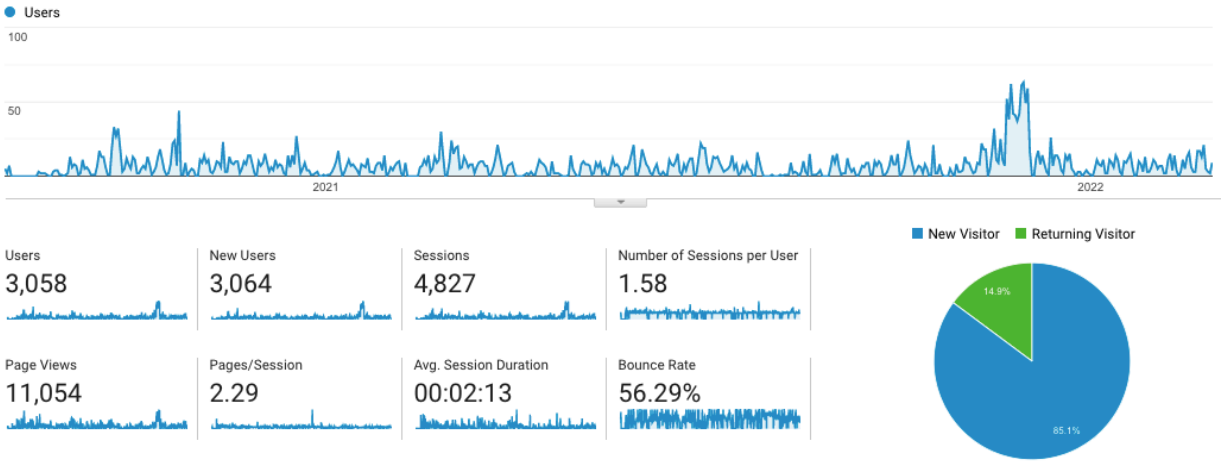

Figure 3: 5G-Blueprint website statistics

All information and e-mails collected are protected under the General Data Protection Regulation (GDPR). Contact is and will continue to only be made with people who have submitted inquiries. Similarly, the newsletters are and will continue to be sent out only to individuals who have explicitly requested to receive them. Any person who has subscribed can request for their e-mail address to be removed from the list. The website provides information on the data kept and how they are used in alignment with the GDPR under the Privacy policy link (footer of the webpage).

Last but not least, 5G-Blueprint opted for an environmentally responsible website hosting platform, which has been designed to be as energy efficient as possible to limit the unnecessary waste of resources. The web hosting provider, GreenGeeks, puts back three times the power consumed into the grid in the form of renewable energy.

2.1.3 Social media channels

5G-Blueprint established its presence on social media channels to regularly promote project activities and outputs while encouraging a wider discussion on topics related to 5G research and deployment as well as the teleoperation of vehicles and vessels. The project has built a fair follower base on several social media channels, namely Twitter, LinkedIn, and YouTube, which are all linked to the project's website.

2.1.3.1 Twitter

5G-Blueprint uses Twitter, as it is a very dynamic social network covering the news in real-time at a global level. To date, the 5G-Blueprint Twitter account (@5G_Blueprint) has attracted 195 followers. The project follows 81 accounts, mostly projects and initiatives in similar fields. The project Twitter account is used predominately to promote and disseminate project activities and developments but also to learn about and cross-share relevant and interesting events and initiatives, and to establish meaningful connections with relevant stakeholders, including policy makers, industry, and the general public.

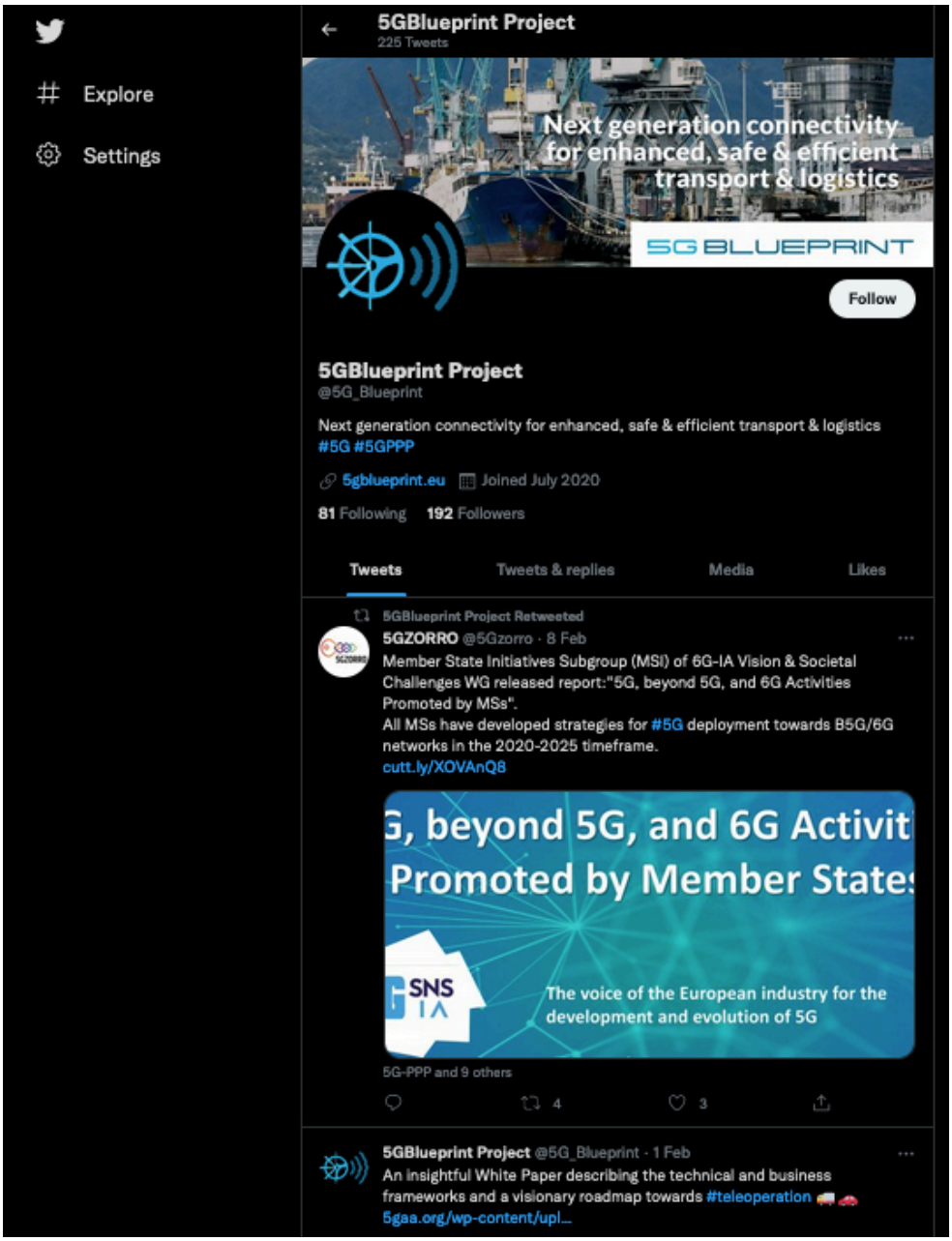

Figure 4: 5G-Blueprint Twitter profile (dark mode)

2.1.3.2 LinkedIn

LinkedIn, as one of the biggest business networks in the world (over 150 million users in more than 200 countries and territories), is a useful tool for 5G-Blueprint. It allows the project to network with individuals and organizations within the industry and beyond, share relevant information about project activities, and stay up to date on the latest developments in the field. To date, the 5G-Blueprint LinkedIn account (5gblueprint-project) has attracted 190 followers. Similar to Twitter, the LinkedIn account is used to promote project activities and learn about and cross-share relevant events and activities. Figure 5 presents the project's LinkedIn profile.

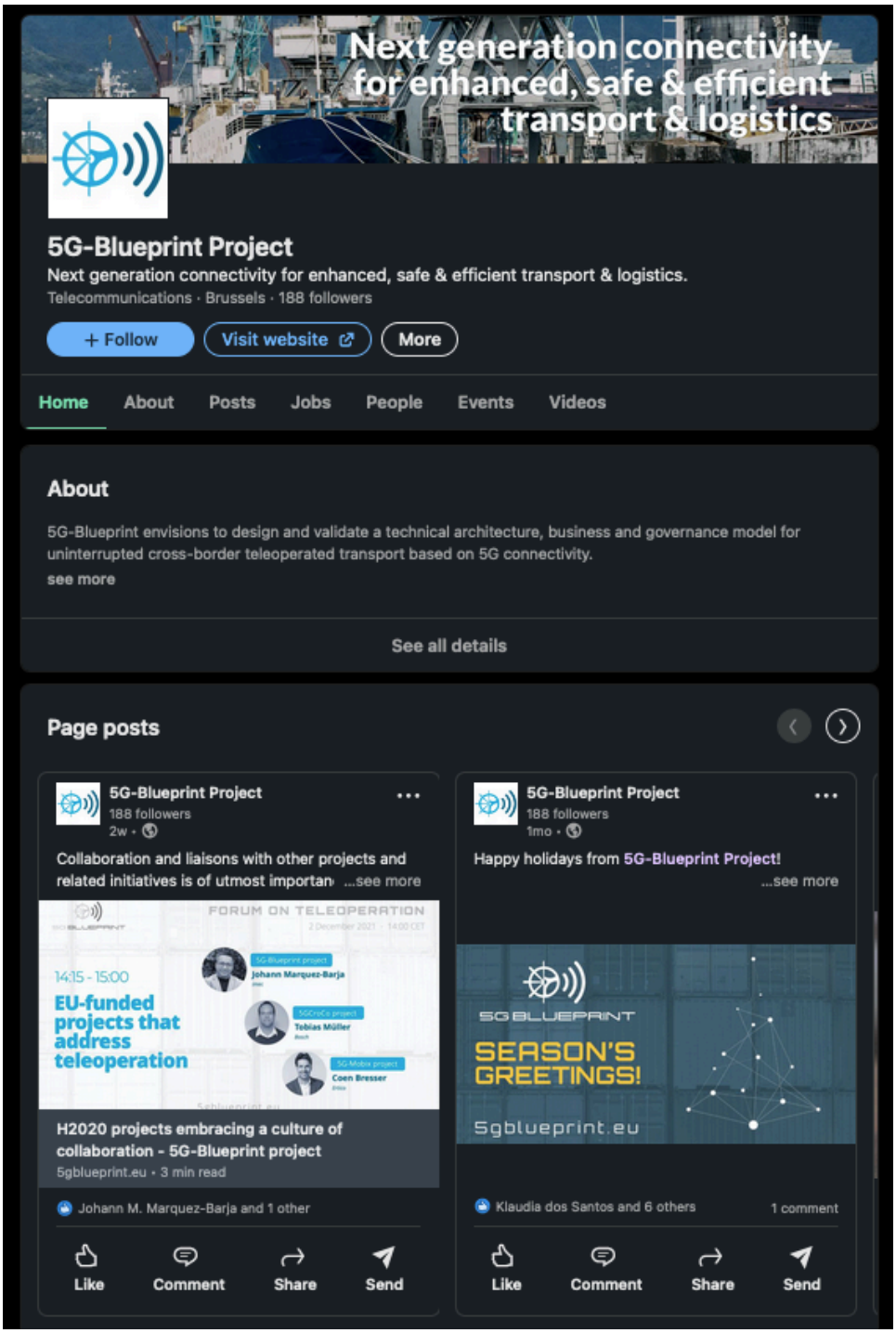

Figure 5: 5G-Blueprint LinkedIn profile (dark mode)

2.1.3.3 YouTube

5G-Blueprint has also created an account on YouTube, one of the leading video-sharing platforms. This channel has been opened at the early project stages to disseminate the first project video. Since then, the project has released a total of 6 videos, including the recordings from a project webinar. 23 subscribers follow the 5G-Blueprint YouTube channel, which can be found at the following link: https://www.youtube.com/channel/UCv7n1u2SLeRH6DRJpfdGtrA

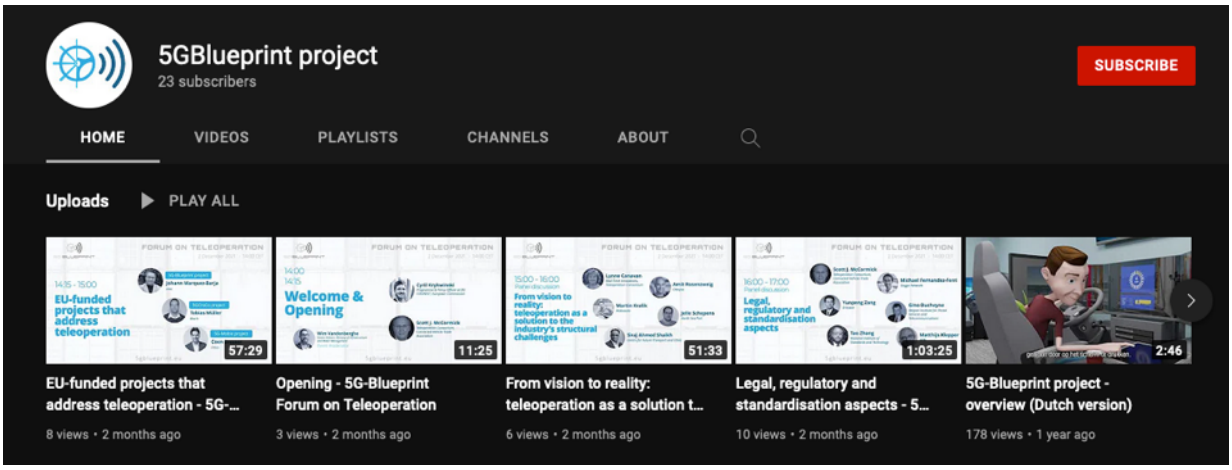

Figure 6: 5G-Blueprint YouTube channel (dark mode)

2.1.4 News items and press releases

The 5G-Blueprint consortium keeps the community and the general public informed about relevant activities, undertakings, and events by publishing news items and press releases. To date, 32 news items and two press releases have been published on the project website.

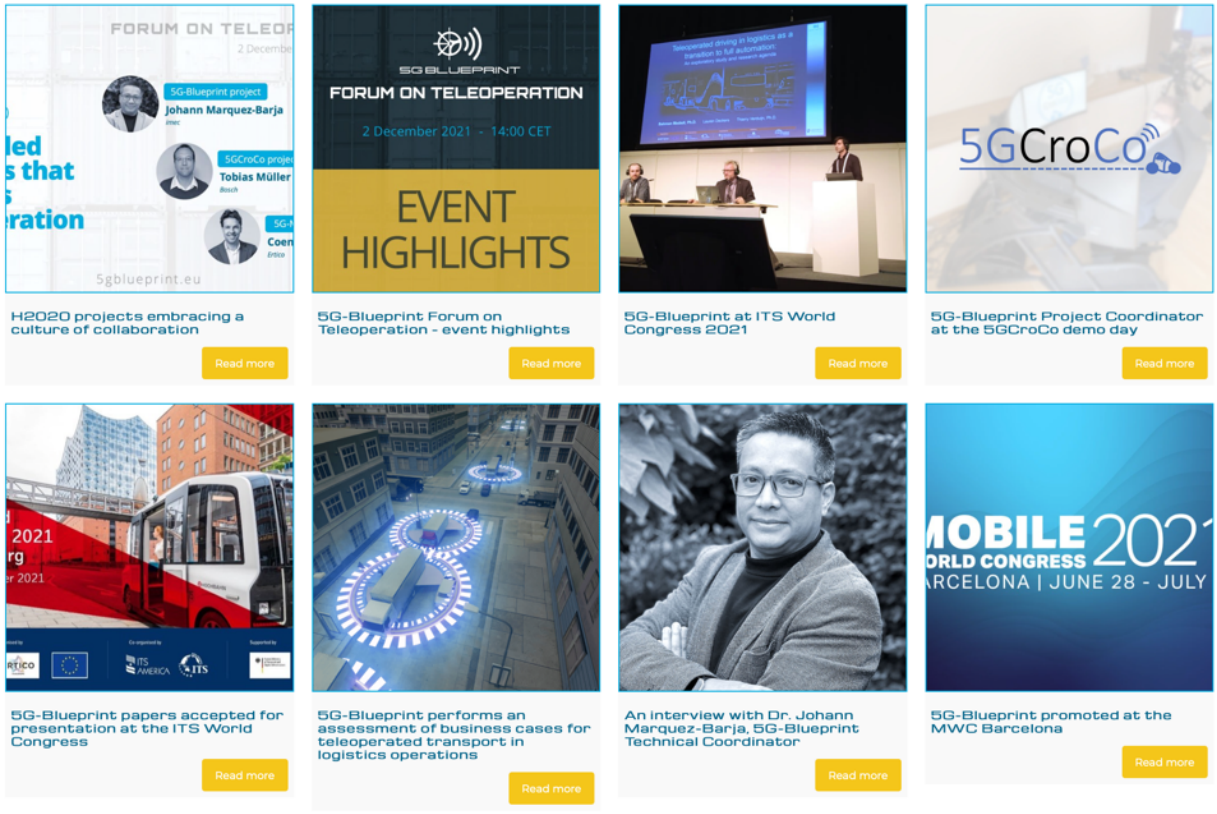

Figure 7: News items published on the 5G-Blueprint website

2.1.5 Newsletters and newsflashes

The 5G-Blueprint periodic newsletter is sent out twice a year, providing updates on the 5G and CAM ecosystems, as well as on the project activities, findings, and results. The project newsletters also contain information on the upcoming tasks, events, as well as any relevant news and announcements from individual project partners when relevant. A mailing list based

on subscription has been created, giving the possibility to share the newsletter via mass mailing. A registration functionality allowing interested visitors to subscribe to the newsletter has been available on the project website since the beginning of the project. The design of each newsletter is aligned with the 5G-Blueprint brand identity. The newsletter is also fully responsive to ensure its readability on any device.

All issued newsletters are being uploaded on the website upon their distribution to subscribers. To date, 3 newsletters have been sent out (see Figure 8), the first edition in February 2021 (M06), second in August 2021 (M12), and the third in February 2022 (M18).

In addition to sending out bi-yearly newsletters, the consortium sends out topical newsflashes when important announcements need to be made. As such, a newsflash containing information about the 5G-Blueprint Forum on Teleoperation and season's greetings has been distributed in December 2021 (M16).

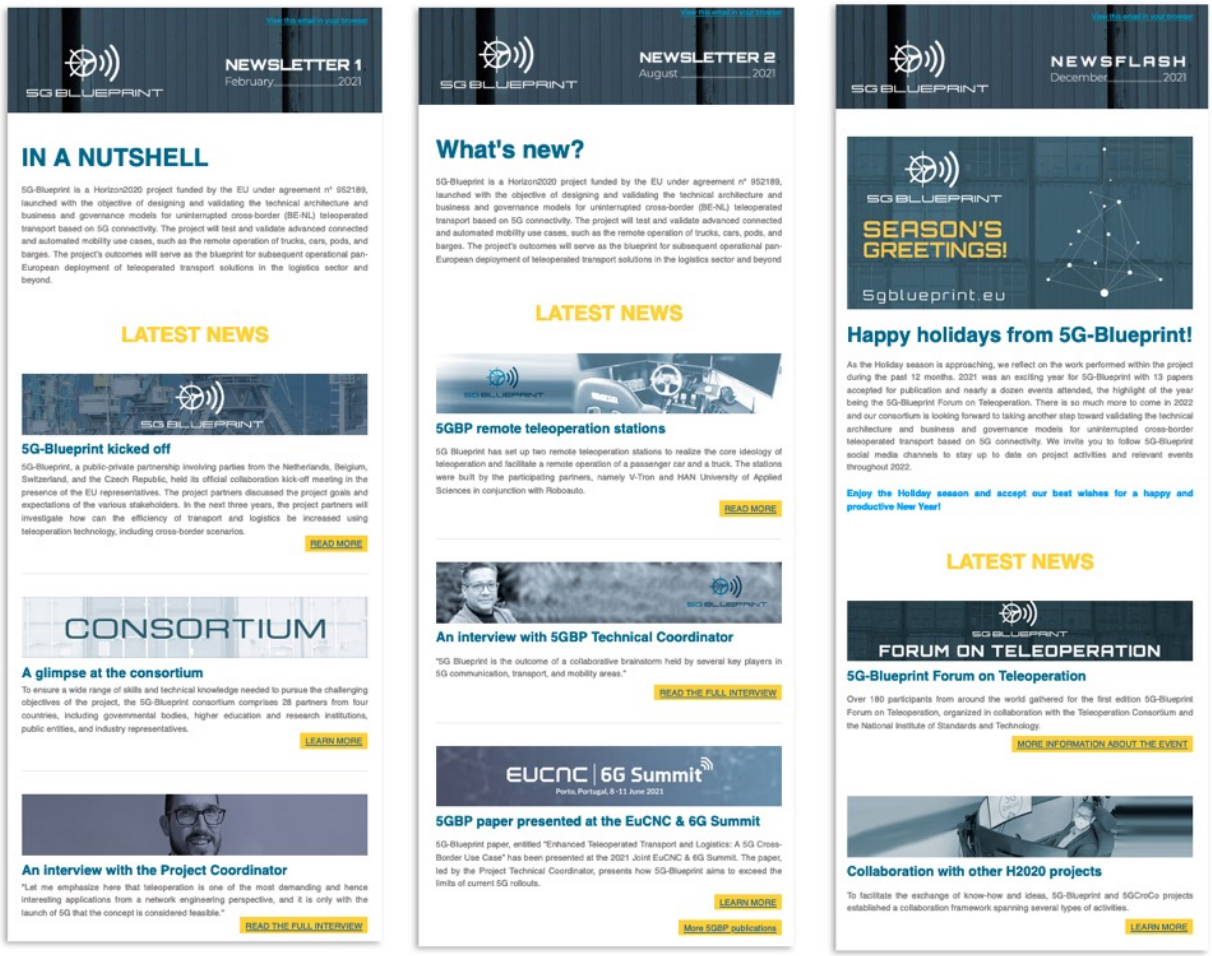

Figure 8: 5G-Blueprint newsletters

2.1.6 Publications

The 5G-Blueprint consortium is committed to bringing research results closer to the public and adheres to the Open Access guidelines set by the H2020 work programme. All project partners are strong supporters of Open Access as it enables all interested parties to use published research results irrespectively of their location or income, boosting the transfer of knowledge between science, the economy, and society at large. The project has been very active in that sphere since its early stages. The below table lists all the accepted/published papers stemming from 5G-Blueprint.

Title	Authors	Venue
Enabling cross-border teleoperated transport in the 5G Era: The 5G Blueprint approach	Johann Marquez-Barja, Seilendria A. Hadiwardoyo, Vasilis Maglogiannis, Dries Naudts, Ingrid Moerman, Peter Hellinck, Sofie Verbrugge, Simon Delaere, Wim Vandenberghe, Eric Kenis, Maria Chiara Campodonico, Rakshith Kusumakar, kJob Meines, Joost Vandenbossche	CCNC 2021
Enhanced Teleoperated Transport and Logistics: A 5G Cross-Border Use Case	Johann Marquez-Barja, Seilendria A. Hadiwardoyo, Bart Lannoo, Wim Vandenberghe, Eric Kenis, Lauren Deckers, Maria Chiara Campodonico, Klaudia Dos Santos, Rakshith Kusumakar, Matthijs Klepper, Joost Vandenbossche	EUCNC 2021
The importance of business and governance model blueprints for teleoperated transport in cross-border settings	Asma Chiha, Pol Camps-Aragó, Frederic Vannieuwenborg, Lauren Deckers, Eric Kenis, Wim Vandenberghe, Edwin Bussem, Simon Delaere, Thierry Verduijn, Sofie Verbrugge, Didier Colle	27th ITS World Congress,
Smart Highway: An Interoperable V2X Testbed for Connected and Autonomous Mobility Services in Belgium	Seilendria Hadiwardoyo, Vasilis Maglogiannis, Dries Naudts, Erik de Britto e Silva, Daniel van den Akker, Dieter Balemans, Ingrid Moerman, Peter Hellinckx, Johann Marquez-Barja	27th ITS World Congress,
Teleoperated driving in logistics as a transition to full automation: An exploratory study and research agenda	Lauren Deckers, Bahman Madadi, Thierry Verduijn	27th ITS World Congress,
Vehicular Communication Management Framework: A Flexible Hybrid Connectivity Platform for CCAM Services	Dries Naudts, Vasilis Maglogiannis, Seilendria Hadiwardoyo, Daniel van den Akker, Simon Vanneste, Siegfried Mercelis, Peter Hellinckx, Bart Lannoo, Johann Marquez-Barja and Ingrid Moerman	Future Internet. pp 1-17. March, 2021
5G-Blueprint: Next Generation Connectivity for Enhanced, Safe, Efficient Transport & Logistics	Johann M. Marquez-Barja, Seilendria Hadiwardoyo, Wim Vandenberghe, Eric Kenis, Maria Chiara Campodonico, Klaudia dos Santos, Rakshith Kusumakar, Matthijs Klepper, Geerd Kakes, Joost Vandenbosche	5G CAM summit 2021
A Toolkit for Visualizing V2X Messages on the Smart Highway Testbed	Erik de Britto e Silva, Jaimie Vranckx, Tom de Bruyn, Vincent Charpentier, Seilendria A. Hadiwardoyo and Johann Marquez-Barja	25th DS-RT
Collaborative orchestration of multi-domain edges from a Connected, Cooperative and Automated Mobility (CCAM) perspective	N. Slamnik-Kriještorac, G. M. Yilma, M. Liebsch, F. Z. Yousaf, and J. M. Marquez-Barja.	IEEE Transactions on Mobile Computing
Designing a 5G architecture to overcome the challenges of the teleoperated transport and logistics"	Johann M. Marquez-Barja, Dries Naudts, Vasilis Maglogiannis, Seilendria A. Hadiwardoyo, Ingrid Moerman, Matthijs Klepper, Geerd Kakes, Xiangyu Lian, Wim Vandenberghe, Rakshith Kusumakar, Joost Vandenbossche	IEEE 19th CCNC

Table 1: Papers published by 5G-Blueprint

2.1.7 Project videos

In an effort to bring the project objectives and activities closer to the general public, on September 21, 2020, the project released its first video titled "*Teleoperation: the next steps in logistics*". The animated video, available in English and Dutch, provides an overview of the logistics sector and presents the potential of teleoperation. The video begins with the introduction of the wider context and the challenges facing the logistics and transportation sectors, to then introduce digitization and enhanced telecommunication as concrete options for improvement. The second part of the video describes the concept of teleoperation, presenting an example of a remote-control station and focuses on the potential of 5G to address current challenges in logistics by offering safer, smarter, and more sustainable solutions.

The English version of the video counts 630 views while the Dutch one counts 180. The video is available on both the project website and the project YouTube channel.

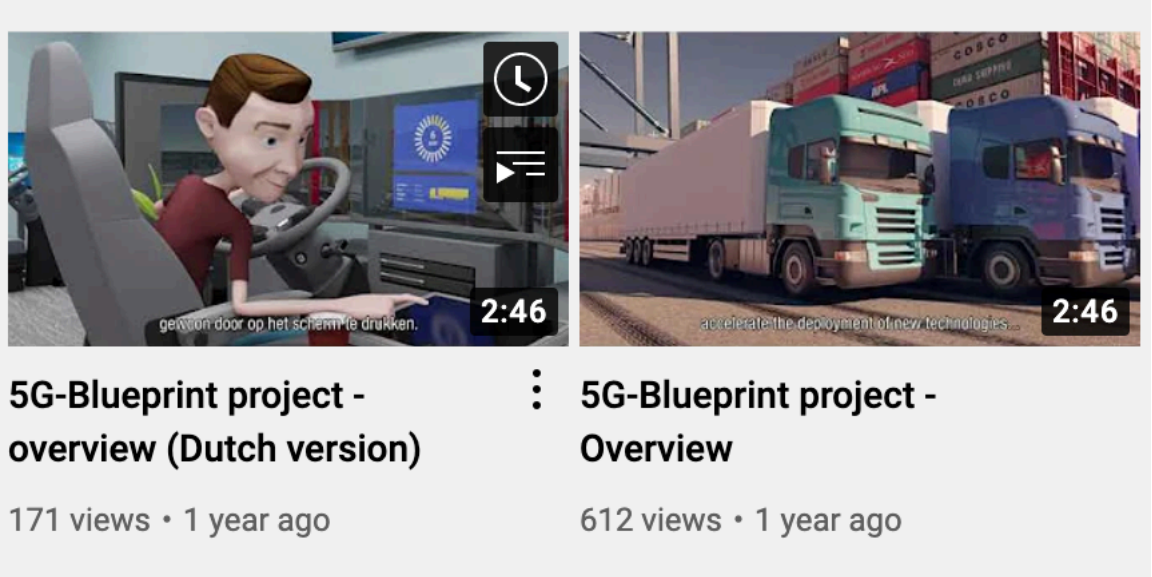

Figure 9: First project video titled "Teleoperation: the next steps in logistics"

2.1.8 Minor-course 'Automated Vehicles in Logistics'

The minor course 'Automated Vehicles in Logistics' for bachelor students was organized for the first time in the first semester of the academic year 2021-2022 at the HZ University of Applied Sciences in Vlissingen. The course offered opportunities for bachelor students to explore the technology of connected and autonomous vehicles and the requirements and opportunities for its deployment. It was a successful start as the technology part has been delivered by an expert in the field. The teacher provided a broad theoretical overview and a practical part where the students were working on a real business case and programmed pi-racers to drive automatically applying the information from the course. In the applications part, which was held in parallel, the students were informed about current projects in different fields of application. Eight guest lectures were given by companies (6) and educational institutions (2). The second part of the course focused on society and ecosystems with lectures provided by the HZ, in addition to a practical assignment, for which there where three groups supervised by three different research groups at the HZ Department of Technology, namely, "Autonomous barging in container transport," "Comprehensive design of a safety case for autonomous transport on public roads," and "Developing a robot for an autonomous vessel". Each of them was completed successfully and provided valuable insights for the students. In the second semester of the academic year the minor course will be repeated with a new group of students and innovative projects.

2.1.9 Digital and printed promotional material

The first brochure providing an overview of the project (see Figure 10) was produced at the beginning of Q1 2021. The 4-page flyer presents the project objectives, use cases, enabling functions, sites, and the project consortium. It also mentions that 5G-Blueprint is part of the 5GPPP, in addition to featuring the acknowledgment of the EU funding.

The flyer in digital format is available on the project website. Its printed version has been distributed among project partners so that they can give it out at attended events.

Figure 10: 5G-Blueprint overview leaflet

2.1.10 Events

Event organization and attendance are an important aspect of the 5G-Blueprint communication and dissemination plan. Although this type of activity has been hindered in the first half of the project due to the ongoing COVID-19 pandemic, various 5G-Blueprint project partners still managed to attend a number of (mostly) online events to promote the project and increase its visibility. Table 2 provides further details on attended events.

Event name	Location and date	Event website	Type of contribution	Partners involved
5GAA community building workshop	Online October 21, 2020	https://5gaa.org/calendar/	Presentation	MIW
5G PPP Webinar: 5G for Cooperative, Connected	Online November 6, 2020	https://5g-ppp.eu/event/5g-ppp-webinar-ccam/	Presentation	imec

and Automated Mobility				
US National Institute of Standards and Technology Vehicle Teleoperation Forum	Online November 13, 2020	https://www.nist.gov/news-events/events/2020/11/nist-vehicle-teleoperation-forum	Presentation	MIW
IEEE Consumer Communications and Networking Conference	Online January 11, 2021	https://ccnc2021.ieee-ccnc.org/detailed-program#S17CCNC2021	Paper	imec
IoT Convention Europe	April 1-2, 2021	https://insightz.io/content/97/IoT-5G-Summit	Keynote	imec
IEEE 5G Virtual Summit	Online May 11-12, 2021	http://5gsummit.org/CAM/	Presentation	MIW, imec
EuCNC 2021	Online June 8-11, 2021	https://www.eucnc.eu	Paper	imec
MWC 2021	Barcelona, Spain June 28-July 1, 2021	https://www.mwcbarcelona.com	Project promotion by the attending project partner	MIW
Design and development of 5G mobile netwoks systems for Smart Industry event.	Online 20 August 2021	https://www.unipd.it/en/	Presentation	imec
ITS World Congress 2021	Hamburg, Germany October 11-15, 2021	https://itsworldcongress.com	3 papers	imec, HZ
Stakeholder workshop 5G corridors for CEF Digital	Online October 20, 2021	https://5g-mobix.com/newsandevents/events/stakeholder-workshop-on-5g-corridor-deployment-in-the-perspective-of-cef2-digital-and-the-recovery-and-resilience-plan-1	Presentation	MIW

Table 2: Events attended in the first half of the project

2.1.10.1 Events organized

During the first 18 months of the project, 5G-Blueprint organized a number of internal (open to project partners and/or project partners and AB members) and one external event (open to public). The most interesting/relevant ones are described below.

Workshop on business models for teleoperation

On February 11, 2022, the WP dedicated to CAM governance and business models held an internal workshop on business models for teleoperation. Next to the project consortium members, the project advisory board members were encouraged to participate and provide their input. The objective of this workshop was to engage in an open and in-depth discussion about possible business models related to teleoperation of barges and trucks. The focus has been put on teleoperation deployment options and business models for the teleoperation center's management role. Having gathered nearly 30 attendees, the session proved very successful. The results of discussions that took place during the workshop will feed the project deliverable D3.2, serving as a basis for the set of identified business model options.

Inception workshop – 5G-Blueprint Forum on Teleoperation

Figure 11: 5G-Blueprint Forum on Teleoperation banner and screenshot of the event

On December 2, 2021, the project organized an online event titled, 5G-Blueprint Forum on Teleoperation. The event was organized in collaboration with the Teleoperation Consortium and the National Institute of Standards and Technology and was divided into three sessions.

- The opening remarks were given by Cyril Krykwinski, Programme & Policy Officer at DG CONNECT, European Commission and Scott J. McCormick, the CEO of Teleoperation Consortium and Connected Vehicle Trade Association.
- Session 1 featured presentations delivered by representatives of three EU-funded projects that address teleoperation (5G-Blueprint, 5GCroCo, 5G-Mobix) and a panel discussion focused on the relation between autonomous and teleoperated mobility and the different approaches to the concept of teleoperation taken by the three projects.
- Session 2, titled From vision to reality: teleoperation as a solution to the industry's structural challenges took the form of a panel discussion and featured both external and (project) internal experts, including Lynne Canavan of Real-Time Innovations and Teleoperation Consortium, Amit Rosenzweig of Ottopia, Martin Kralik of Roboauto, Jelle Schepens of North Sea Port, and Siraj Ahmed Shaikh from the Centre for Future Transport and Cities.
- Session 3, also in a form of a panel discussion, covered legal, regulatory, and standardization aspects and featured Scott J. McCormick of the Teleoperation Consortium and Connected Vehicle Trade Association, Michael Fernandez-Ferri of

Goggo Network, Yunpeng Zang of Ericsson, Tao Zhang of the National Institute of Standards and Technology, Gino Ducheyne of the Belgian Institute for Postal Services and Telecommunications, and Matthijs Klepper of KPN.

The aim of the event was to exchange ideas and lessons learned with representatives of other H2020 projects and external experts from policy, industry, and academia and extend the project network/promote the project beyond the countries where the consortium members are located. We chose the form of a panel discussion to generate an open and honest discussion about the potential and limitations of teleoperation, with the intention of providing the answers to the following questions (among others):

- Will teleoperation revolutionize the transportation and logistics sectors?
- Is this an attractive career path?
- Is a common regulatory framework a possibility? How does it currently look in the USA, Europe, and other places?
- Could teleoperation solve current challenges, such as the HGV driver shortage?

Bringing together distinguished experts from Europe, North America, and Asia allowed us to generate lively and compelling discussions and facilitated knowledge and best practices exchange among panelists. The involvement of experts from different geographical areas with different level of technologies and regulations provided us with input for the blueprint that is under development in our project. This included that in terms of later deployment of teleoperation technology, that it is advised to take it one step at a time, starting with deployment in less complex operational design domains such as valet parking or small confined area's in a port environment, allowing the technology to evolve based on these actual usages to latter tackle more complex ODD deployments. Another key message was that both teleoperation and automation technologies are intrinsic complementing and equally important CCAM technologies, and not competing ones (as was more the 5G-Blueprint project mindset in its early days) or ones where the one is only the assistant function of the other (the way of looking at teleoperation by the projects that preceded 5G-Blueprint, just a solution for helping out a stranded autonomous vehicle).

The event was quite successful in terms of participation, having gathered over 180 participants from around the world. The number of followers on LinkedIn has also increased because of the promotion of the event, as shown in Figure 11.

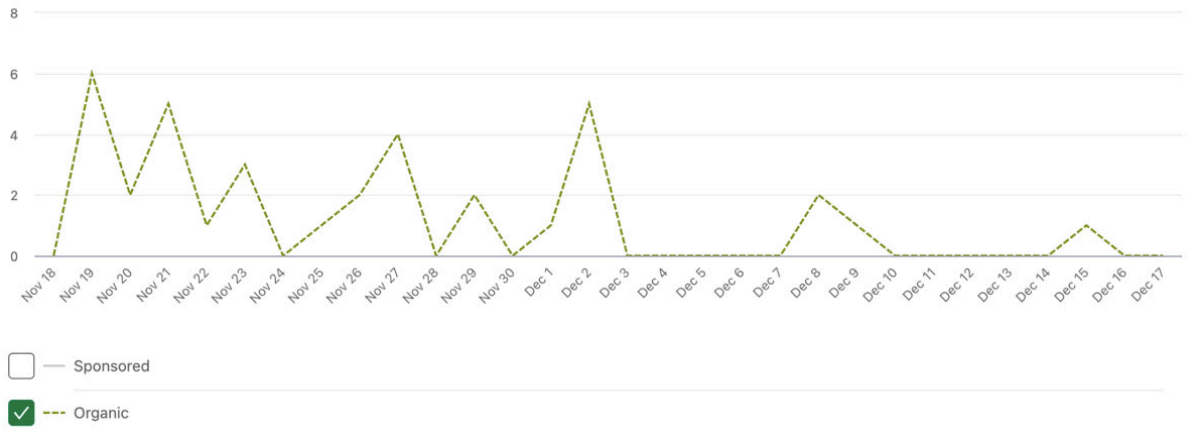

Figure 12: Growth on LinkedIn followers after the 5G-Blueprint Forum on Teleoperation (LinkedIn analytics)

A news item with event highlights was published shortly after the event: https://www.5gblueprint.eu/5g-blueprint-forum-on-teleoperation-event-highlights/

It includes all presentations and session recordings, which can also be found on the project's YouTube channel:

- Opening remarks: https://www.youtube.com/watch?v=oESqSCaCl_4
- Session 1: https://www.youtube.com/watch?v=SCG0dPnsLI8&t=1s
- Session 2: https://www.youtube.com/watch?v=aAECIwAUR6g&t=3s
- Session 3: https://www.youtube.com/watch?v=HcapeJKMpVM

2.2 Collaboration and liaisons with other projects and relevant initiatives

2.2.1 Liaisons within the 5G PPP landscape

After a careful analysis of the portfolio of the 5GPP projects, several CCAM projects have been identified as having interesting commonalties with 5G-Blueprint from use case and connectivity perspectives and liaisons with them have therefore been established. Depending on the project, different activities have been pursued, such as engaging in an active dialogue, keeping track of new deliverables and other publications, and analysing their content. At the moment, 5G-Blueprint liaises with the following 5G PPP projects:

- **5GCroCO** and 5G-Blueprint are engaged in an active and dynamic collaboration. To facilitate the process of exchanging know-how and ideas, the two projects have established a collaboration framework spanning several types of activities. One of the first steps has been the appointment of Wim Vandenberghe, the 5G-Blueprint project coordinator to the 5GCroCo advisory board. As such, Vandenberghe not only attends the regular 5GCroCo Advisory Board online meetings but also participates in the 5GCroCo events, such as the demonstration days held in October 2021. 5GCroCo representatives will also attend the 5G-Blueprint demonstration events. Upon suggestion from the EC, the two projects have held a joint teleconference to discuss the details of their respective teleoperated driving use cases. The valuable discussion has led to the invitation of the 5GCroCo representatives to the 5G-Blueprint Forum on Teleoperation, which took place on December 2, 2021. 5GCroCo was one of the three projects presented during the event. 5GCroCo and 5G-Blueprint also support each other in their respective communication and dissemination efforts. The communication teams inform each other of relevant events and papers and cross-share each other's articles and social media posts in an effort to reach an even larger audience and raise awareness about the work performed within both projects.
- **5G-MOBIX** and 5G-Blueprint have two common consortium members, namely imec and KPN. These organizations are responsible for interchanging knowledge and experience between both projects, which happens mainly within the context of WP5, and hence with an emphasis on connectivity aspects. In the same context, KPN will make use of the 5G-MOBIX test site in Helmond to facilitate 5G-Blueprint integration testing, allowing 5G-Blueprint to perform the system integration before its pilot sites go live in Vlissingen, Zelzate, and Antwerp. Furthermore, 5G-Blueprint makes sure to always have a representative of the project present at the different 5G-Mobix webinars, disseminating the learnings from those webinars to all 5G-Blueprint consortium members. This way, the exchange of knowledge between the projects is strengthened further. And finally, the communication and dissemination teams of 5G-Blueprint and 5G-MOBIX actively collaborate in a similar manner to that described above in the paragraph about the liaisons with the 5GCroCo project.
- **5GMED**: from a content exchange perspective, to date, liaisons with 5G-Med have been limited to keeping track of new deliverables and analyzing their content. Next to that, the

communication and dissemination teams of both projects kept an active dialogue, sharing relevant news, events, and similar activities. Recently, a stronger collaboration has been established (more information in 2.2.1.1).

- **INGENIOUS**: from a content exchange perspective, the liaisons with 5G-Med are limited to keeping track of new deliverables and analyzing their content. At a later stage, the 5G-Blueprint communication and dissemination team will initiate a dialogue in an effort to cross-promote the impact creation activities of both projects.

In addition, 5G-Blueprint representatives participated in a number of 5G PPP events and provided an editorial contribution to the Phase 3 5G PPP projects' brochure.

2.2.1.1 H2020 ICT-53 projects' communication and dissemination task force

5G-Blueprint takes part in H2020 ICT-53 projects' communication and dissemination task force initiated by the 5GMED project. The first task force meeting took place on January 18, 2022, and gathered representatives of 5GMED, 5G-Blueprint and 5G Routes. The purpose of the meeting was to define the objectives and the preliminary work plan of the task force. As such, three main general objectives have been agreed upon, namely,

- Maximization of the impact of the ICT-53 projects by identifying joint communication and dissemination activities.
- Sharing best practices and communication and dissemination strategies in the context of CCAM, 5G, and cross-border handovers.
- Organization of joint events and webinars to increase the visibility of H2020 ICT-53 projects and uptake of their results.

During the first task force meeting, project representatives have also decided on the first joint activity, i.e., the development and submission of a workshop proposal to the EuCNC 2022.
Unfortunately, the proposed workshop was not accepted but the task force has been established and periodic calls are organized to share the results and challenges and to organize joint activities such as the participation to relevant conferences or to mutual events such as demos and webinars on specific topics.
Moreover, the Dissemination Task Force has enabled to gather a Technical Task Force, where the Technical Management Committees of each ICT-53 project exchange technical approaches and information not only via mailing lists but also by joint meetings. The first one was organized at the 5G CAM Symposium and further ones are foreseen in 2023.

2.2.2 Liaisons with other relevant initiatives

Next to liaisons with the 5G PPP-related initiatives described above, the following collaborations with other relevant initiatives have been initiated:

- **5G IA**: imec represents 5G-Blueprint in the 5G CAM WG, and the Smart Networks WG, where several European projects gather to share experiences and to push collaboratively further the state of the art of 5G technologies and related verticals. Within 5G CAM WG, 5G blueprint contributes weekly to the progress of several inter-project initiatives, and representing the ICT-53 wave perspective.
- **5GAA**: The 5G Automotive Association is a global, cross-industry organization of companies from the automotive, technology, and telecommunication industries, working together to develop end-to-end solutions for future mobility and transportation services. Created in September 2016, the 5GAA counts more than 130 members. MIW is not a full member of the 5GAA but it has signed a Memorandum of Understanding (MoU), effectively establishing a mutually beneficial cooperative relationship in areas of common interest. This MoU arranges confidentiality, facilitating the information

exchange between both parties, and the participation of MIW in 5GAA meetings. As part of this cooperation, MIW has actively participated in the 5GAA's Teleoperation Work Item. As a representative of 5G-Blueprint, MIW contributed to discussions and reports on use cases and system architecture and took the lead on the activities regarding business considerations. All these results can be found on the 5GAA website[1][2][3]. They were also summarized in a 5GAA whitepaper on teleoperation, which was also published on the 5GAA website[4], and to which MIW also actively contributed. And finally, to create further awareness about the 5G-Blueprint project among the 130 5GAA members, MIW introduced the project during the 5GAA community building workshop. The presentation was delivered by the 5G-Blueprint coordinator, Wim Vandenberghe on October 21, 2021. The Community Building Sessions are an integral part of the 5GAA quarterly meeting weeks offering an overarching platform to share news on market-ready C-V2X services and devices or other relevant initiatives with other 5GAA members. The format is based on the concept of "Slam Presentations", informing the entire 5GAA community in a 5-minutes pitch, facilitating broad awareness and subsequent bilateral discussions within the 5GAA community.

- **AECC:** the Automotive Edge Computing Consortium works with leaders across industries to drive the evolution of edge network architectures and computing infrastructures to support high volume data services in a smarter and more efficient connected-vehicle future. It is chaired by the Toyota Motor Corporation (TME). As a representative of 5G-Blueprint, TME actively exchanges information about mobile edge computing between 5G-Blueprint and their Asian colleagues who participate in the AECC.
- **NIST:** on November 13, 2020, the US National Institute of Standards and Technology held a full day virtual forum designed to bring leaders from the industry, academia, and government agencies to discuss the challenges, opportunities, and potential paths forward in vehicle teleoperation. MIW (Wim Vandenberghe) presented 5G-Blueprint in the first session of the day, the "Government Panel". A recording of the event can be found on the NIST website[5]. This collaboration resulted in the collaboration with the Teleoperation Consortium (teleoperation.org), as described hereunder.
- **Teleoperation Consortium (TC)** is a non-profit business league established to facilitate interactions and advance interests of the entities involved in the teleoperation ecosystem. The Teleoperation Consortium enables the collaboration of companies, organizations, and governmental bodies engaged in developing bidirectional vehicle communications. Membership is open to any corporation, public entities, standards and specification organizations and academic institutions. The 5G-Blueprint team liaises directly with the TC CEO regarding relevant events and similar activities. As such, the TC helped to organize the 5G-Blueprint Forum on Teleoperation. A possibility of signing an MoU is currently under discussion (5G-Blueprint is not eligible to join the TO as a regular member).
- **CCAM Association** is the international not-for-profit organisation representing the private side of the CCAM Partnership, regrouping more than 180 innovation stakeholders involved in the connected, cooperative and automated mobility field. Imec, MIW and MOW are members. CCAM supported the promotion of 5GBlueprint event.

[1] https://5gaa.org/news/tele-operated-driving-tod-use-cases-and-technical-requirements/
[2] https://5gaa.org/news/tele-operated-driving-tod-system-requirements-analysis-and-architecture/
[3] https://5gaa.org/news/tele-operated-driving-tod-business-considerations/
[4] https://5gaa.org/news/tele-operated-driving-use-cases-system-architecture-and-business-considerations/
[5] https://www.nist.gov/news-events/events/2020/11/nist-vehicle-teleoperation-forum

Within this association imec, representing 5G Blueprint aims to bridge the the automotive and communications perspective of CCAM association.

2.3 Impact assessment

The project has defined a comprehensive set of communication and dissemination KPIs (see Table 3) to monitor the progress achieved across online and offline outreach and impact creation channels.

Measure	**Indicators**	**Target** (M36)	**Status at M18**
Project website	Total visits	2.500 *(per year)*	4.827 (*6 months)*
Social Media	Twitter followers	> 250 *(by the end of the project)*	195
	LinkedIn followers	>100 *(by the end of the project)*	190
e-Newsletters	Number of newsletters developed	2 *(per year)*	3
	Number of contacts receiving the newsletter	200 *(per edition)*	207
Events Participation	Number of scientific events participated in	10+	5
	Number of non-scientific events participated in	10+	6
Events Organization	Number of events organized	3	1
	Number of participants	100+	180+
Videos	Number of videos developed	3	1
Brochures/leaflets	Number of brochures printed and distributed	500	Only digital version has been distributed due to pandemic-related restrictions
Scientific publications	Number published	20+	14
MOOC	No of MOOC organized	1	1

Table 3: Communication and dissemination KPIs

No.	**Milestone Name**	**Lead**	**Due**	**Status**

MS18	5G-Blueprint website ready	MAR	M1	Achieved
MS19	Inception Workshop completed	MAR	M16	Achieved
MS20	Engagement Workshops completed	MAR	M24	Planned
MS21	Final showcase completed	MAR	M36	Planned

Table 4: Communication and dissemination-related milestones

No.	Deliverable Name	Lead	Type	Diss level	Due	Status
D8.1	Dissemination, and communication and plan	MAR	R	PU	M3	Submitted
D8.2	5G-Blueprint visual identity and promo toolkit	MAR	OTH	PU	M2	Submitted
D8.3	Intermediate Dissemination, Standardization, Exploitation and Joint Activities Report	MAR	R	PU	M18	Current document
D8.4	Final Dissemination, Standardization, Exploitation and Joint Activities Report	MAR	R	PU	M36	Planned
D8.5	Minor-course Automated Vehicles in Logistics	HZ	R	PU	M09	Submitted
D8.6	Automated Vehicles in Logistics	HZ	R	PU	M36	Planned

Table 5: WP8 deliverables

2.4 Updated communication and dissemination strategy M19-M36

The communication and dissemination strategy developed at the beginning of the project has proven successful thus it will be continued without major modifications. In M19-M36, the strategy will evolve mostly around activities listed below.

2.4.1 Communication and dissemination via project website and social media channels

5G-Blueprint will continue to grow its community via the established channels including, but not limited to, the project website and its social media channels, namely Twitter, LinkedIn, and YouTube. Relevant project findings will be made available (as long as not confidential) to the general public to keep the community updated about relevant project activities, findings, and results. This will be achieved through publication of regular news items, press releases, social media posts, and via the bi-yearly project newsletter and ad hoc newsflashes. As the project advances, more presence on social media is to be expected. Twitter and LinkedIn will be used

not only to disseminate project results but also to attract new stakeholders to the 5G-Blueprint ecosystem. Additionally, amendments to the website content have been planned – addressing recommendations from the first project review – in order to better contextualize the project's work within the 5G market landscape.

2.4.2 Events

2.4.2.1 Event attendance

Although event participation will most likely continue to be hindered in 2022 due to the ongoing COVID-19 pandemic, the consortium aims to be present at a number of relevant events in order to promote project activities and increase its visibility. Table 6 presents upcoming relevant conferences where the consortium intends to promote 5G-Blueprint.

Event name	Location and date	Event website	Type of contribution	Partners involved
MWC 2022 Session 5G Along Transport Corridors in Europe	Barcelona, Spain February 28 – March 3, 2022	www.mwcbarcelona.com	Speaker/panelist	MIW
Use Cases, System Architecture and Business Considerations of Teleoperated Driving	Online March 1, 2022	https://5gaa.org	Speaker/panelist	MIW
Future Global Network Development Summit	Barcelona, Spain March 16-17, 2022	www.futurenetworksummit.com	Presentation	KPN
ITS Europe	Toulouse, France May 30 - June 1, 2022	www.itseuropeancongress.com	Presentation	MOW
EuCNC 2022	Grenoble, France June 7-10, 2022	www.eucnc.eu	Speakers/ panellists at three different workshops	MAR, imec, NSP, Seafar, PoA
IoT Week 2022	Dublin, Ireland	www.iotweek.org	Presentation of first results	imec

Session 5G for CAM	June 21, 2022			
Avec'22	Kanagawa, Japan September 12-16, 2022	www.avec2022.org	Paper	HAN
PortsComms 2022	London, UK November 9-10, 2022	www.wireless-networks-in-ports.com	Presentation	imec
EUCAD 2023	Brussels, Belgium 3-4 May 2023	https://erticonetwork.com/event/eucad-2023/	Booth, poster presentation	KPN
EuCNC 2023	Gothenburg, Sweden 6-9 June 2023	www.eucnc.eu	Booth, Paper presentations	TBD

Table 6: Upcoming planned events

2.4.2.2 Organization and active participation to events

EUCAD2023

5G-Blueprint is planning to be present at the 4th European Conference on Connected and Automated Driving on 3-4 May 2023 in Brussels with an information stand and, at the time of drafting of this revised version, is under discussion the possibly to participate also with a Static Demonstration.

Engagement workshop

After the success of the 5G-Blueprint Forum on Teleoperation, the consortium discussed within the ICT-53 task force the idea of a joint workshop in the Special Interest Sessions, which would serve as the second project event, while allowing mutual further stakeholders engagement boost. The result was the creation of a proposal to be summitted to the ITS European Congress 2023, which will take place in Lisbon, Portugal on 22-24 May 2023
The aim of the event will be fostering an open and active dialogue between the ICT-53 projects on lessons learned so far, on both technology and business approaches.
5G-Blueprint, together with all the other ICT-53 projects, considers the ITS congress an excellent opportunity to increase their visibility and the impact of the activities.
The Special Interest Session will offer an opportunity for connecting the dots between the academic sphere (technological development and challenges) and the industry sphere (market needs and acceptance), focusing on the driving concept of cross-border deployment on the three different transport modes: motorways, railways, and waterways.

The idea to attach such workshop to a renowned sector event is to engage a wide range of stakeholders to ensure future uptake of project end results and expand the project's exploitation opportunities.

The scope of the workshop, still under finalization, is the following:

Sustainable deployments of 5G technologies are critical to support the future Connected Automated Mobility (CAM) services along European transport corridors. In transport cross-border corridors, the 5G for CAM ecosystem -in particular MNOs and road/rail/maritim operators- will have separate network and compute infrastructures, each with their own service orchestration capabilities tailored to the specific business of each stakeholder.
To address such heterogeneity among actors involved, technologies addressed and transport modes to be covered, a group of 5G-PPP Research projects (ICT-53: 5G- Blueprint, 5GMED, 5GRail and 5GRoutes) are currently addressing the challenges of validating the latest 5G technologies and build up architectures in a CAM context, including new and innovative business models and the integration of relevant standards. 5GMED aims to bring a sustainable 5G deployment model for future mobility in the Mediterranean Cross-Border Corridor demonstrating advanced CAM and Future Railway Mobile Communications System services (FRMCS). 5G-Blueprint designs and validates a technical architecture and business and governance models for uninterrupted cross-border teleoperated transport based on 5G connectivity. 5GRoutes conducts advanced field trials of most representative and innovative CAM applications seamlessly functioning across a designated 5G crossborder corridor ('Via Baltica-North') spanning across 3 EU member states borders (Latvia-Estonia-Finland). 5GRail aims to validate the first set of FRMCS specifications by developing and testing prototypes of the FRMCS ecosystem, for both trackside infrastructure and onboard.
In this session, a panel discussion with a representative of each ICT-53 project will introduce the challenges, use cases, operational aspects, and applications of three different transport modes: motorways, railways, and waterways. After identifying these items, the session will have special interest in discussing collaborative opportunities across these transport modes and countries, where each speaker will provide lessons learned within the consortium and future guidelines.

EuCNC 2023

5G-Blueprint is planning to be present at the EuCNC & 6G Summit 2023 edition in Gothenburg, Sweden in June 2023 with scientific papers and presentations and with a joint booth with the other ICT-53 projects.

Final event

5G-Blueprint's consortium is planning to organise its final event in November 2023 as a physical standalone event - towards the end of the project - involving the press and revolving around on-site demonstrations (to be conducted in the pilot sites of the project in Belgium and The Netherlands), emphasising the idea of cross-border deployment of the processes and technologies implemented over 5G-Blueprint's run.

2.4.3 Production of promotional material

Additional promotional materials will be produced in alignment with event organization and attendance. As such, before the EuCNC 2022, a 5G-Blueprint roll-up and a flyer presenting use cases and enabling functions will be produced. The consortium has also planned the production of a second video presenting the first project results for the second half of 2022.

2.4.4 Planned papers/publications

As the project advances, more papers are expected to be published in 2022-2023. As such, a paper for the 15th International Symposium on Advanced Vehicle Control (AVEC'22) is currently being developed by HAN University of Applied Sciences. The paper has a working title "Model Predictive Control based Driver Support for Docking of Articulated Vehicles at Logistics Areas" and it is currently at the stage of an extended abstract. More information is expected in March 2022. In the same lines imec is preparing a paper entitled "Towards an Intelligent and Automated Edge Service Orchestration on the Smart Highway Testbed", to be submitted to IEEE Global Communications Conference (IEEE GLOBECOM) 2022, a flagship IEEE conference. Last, but not least, imec is preparing a poster paper about early results to be submitted to EuCNC 2022.

3 STANDARDIZATION

3.1 Objectives of Task 8.3 Standardization

The objective of this task is to identify relevant technologies to be standardized to guarantee the universal adoption of the developed technologies into the market, and to try to positively impact the corresponding standardization activities. For this, the 5G-Blueprint consortium actively follows the activities of a number of standardization bodies and tries to contribute where relevant.

3.2 Standardization plan

The following standardization bodies have been identified as relevant for 5G-Blueprint, and are hence actively monitored in search of contribution opportunities:

- CEN/TC 278 Intelligent Transport Systems
- ISO /TC 204 Intelligent Transport Systems
- ETSI Technical Committee (TC) Intelligent Transport Systems
- 5GAA Work Item Teleoperated Driving (ToD)
- GSMA Seamless Roaming Working Group
- CROW Change Advisory Board on iVRI (aka iTLC or Intelligent Traffic Light Controller)

However, this monitoring has revealed two challenges when it comes to impacting their standardization activities.

Challenge 1: The complexity of organising new work items within a standardization body. This typically involves an intensive process of defining the scope of the new work item, defining the different roles that need to be involved (leads, secretariat, experts, etc.), finding parties willing to take up these roles, (sometimes) acquiring financial resources to perform this activity, and finally, getting the board's approval for the launch of a new work item. Given the limited resources available for standardization activities in the project, it was hence decided that setting up new work items in the selected standardization bodies was not a feasible approach. Instead, project partners agreed that the monitoring should focus on identifying already active work items to which 5G-Blueprint could positively contribute.

Challenge 2: When you define a standard, you have to be certain that the specifications that you are defining will also be suitable in practice. Since 5G-Blueprint is an Innovation Action, this certainty only exists after the successful validation of the developed solutions at the pilot sites. An activity that is only finalized by the end of the project. This means that standardization contributions focusing on the definition of detailed technical specifications can only be made in the last phase of the project. As a result, the list of standardization contributions that are already concretely planned is rather short at this moment. However, it is expected that in the final iteration of this deliverable, namely D8.4 *Final Dissemination, Standardization, Exploitation and Joint Activities Report* due at M36, more concrete contributions will be listed.

Based on the above, for the moment, the following standardization contributions have been defined (see Tables below).

GSMA (SA2 Working Group)	
Topic	Seamless roaming
State of the art	Today seamless roaming is not possible. However, for certain use cases making use of 5G, including teleoperation, this is a necessity for deployment on a larger scale. Therefore, the GSMA has initiated a working group on seamless roaming.
Contribution(s)	Contributing to the definition of a practical data model, message set and interface for seamless roaming.
Participant(s)	KPN TNO

Table 7: 5G-Blueprint contribution towards GSMA

5GAA	
Topic	Teleoperation using 5G
State of the art	As an organization where many representatives of the automotive and telecom sectors come together, it became clear that teleoperation using 5G is an interesting concept, but that many unclarities have to be discussed before it can be considered a feasible option. Therefore, it initiated a Work Item called Teleoperated Driving (ToD)
Contribution(s)	Review of report on use case[6] Active contribution to network requirements and system architecture definitions[7] Lead of the study regarding business considerations[8] Active contribution to the white paper bringing all results together[9]
Participant(s)	MIW

Table 8: 5G-Blueprint contribution towards 5GAA

[6] https://5gaa.org/news/tele-operated-driving-tod-use-cases-and-technical-requirements/
[7] https://5gaa.org/news/tele-operated-driving-tod-system-requirements-analysis-and-architecture/
[8] https://5gaa.org/news/tele-operated-driving-tod-business-considerations/
[9] https://5gaa.org/news/tele-operated-driving-use-cases-system-architecture-and-business-considerations/

CROW	
Topic	Intelligent Traffic Light Controllers
State of the art	In the Netherlands, a new generation of traffic light controllers (iTLC, or in Dutch iVRI) has been created during the Talking Traffic Innovation Partnership. At the moment roughly 1 000 of these new generation traffic light controllers have been deployed throughout the project, and Flanders is starting to do the same as part of the Mobilidata programme. To guarantee the technical stability of the ecosystem, all iTLC related specifications are managed by a Dutch organization called CROW, in which a Change Advisory Board on these specifications has been created.
Contribution(s)	Active contribution to updated specifications regarding priority requests (relevant for Enabling Function 3) Definition of a process for certification of iTLC products using a common testing infrastructure and test case definitions. Specification of the common test cases.
Participant(s)	MIW, MOW, Swarco

Table 9: 5G-Blueprint contribution towards CROW

It should also be noted that it was also investigated if the control messages to create CACC based platoons as part of UC 4.3 could be brought to an appropriate standardization activity. However, further state of the art analysis on this topic made clear that this was already done sufficiently by the Ensemble project, in its deliverable D2.810. Therefore, it was decided to abandon the pursuit of this specific standardization possibility.

A second topic that is considered interesting content for standardization is the mapping between the different data streams needed to perform the use cases and enabling functions of the project, and the slices as defined in 3GPP standards. For the moment, no suitable ongoing standardization activity has been identified, but this search will be continued. If no such activity can be found by the end of the project, alternatively a short draft standard will be written by the project and brought to possibly relevant standardization bodies through liaison statements, allowing the standardization community to continue the work of 5G-Blueprint even after the end of the project.

3.3 Data management and ownership

The 5G-Blueprint consortium determined to opt out from the Open Research Data (ORD) in Horizon 2020 due to the strategic nature of the expected results. The results of this decision are that no specific data is made openly available and there will be no data shared. Beneficiaries of the project that have a significant role in the collection or generation of data are appointed as gatekeepers for this. The data management plan of the project contains fifteen sets of data (see D2.1) and, accordingly, fifteen so-called Data Protection Officers (DPOs). The fifteen datasets are a combined effort based on examined use cases, identified enabling functions and other

[10] https://platooningensemble.eu/storage/uploads/documents/2021/03/24/ENSEMBLE_D2.8_V2X-communication_Final.pdf

specific work packages. The details of the DPOs per dataset can be found in D2.1. Since the data management plan is a living document, reports after M06, M18 and M36, possible alterations in data management and DPOs are made available in that document. Any collected or generated data is presented in a human-readable manner as much as possible, such as plain test, CSV, JSON, or XML, in order to make the data easy processable and interoperable within the mentioned conditions of the project. In case of security risks as a result of making the data human-readable, an assessment will be conducted to reflect on the necessity of creating human-readable datasets. A detailed data protection policy for the entire project is collected by the coordinator. In the end, all generated and collected data will be stored until twelve months after the end of the project and destroyed after this moment has passed. The overall responsible parties for data management in the 5G-Blueprint project are the contributors to T2.3 “Quality insurance, risk management, ethical issues and Data Management Plan”: the Dutch Ministry of Infrastructure and Water Management (coordinator), and Martel Innovate (Project Management Office). However, the aforementioned DPOs’ organizations are always responsible for data management of the individual datasets (and for the resources for their preservation until 60 months after the end of the project).

On the contrary to the above, the results of research and additional papers and information will be shared on social media and the website of the project. Moreover, presentations are being held and conferences are attended for the purpose of knowledge-sharing. Chapter 2 of this document provides a detailed overview of these activities. Public deliverables can be openly accessed by clicking on the ‘Library’ tab of the project’s website (https://www.5gblueprint.eu/library/) and the overarching website for all Horizon2020 projects (https://cordis.europa.eu/project/id/952189). Relevant video materials are published on the project Youtube channel. Again, no specific data is made openly available. If members of the academic community within the 5G-Blueprint consortium desire to strengthen the argumentation or enlighten the readers of academic articles with specific dataset information, the choice can be made to publish specific dataset information by the authors of academic articles.

4 EXPLOITATION

4.1 Overview of exploitation strategy

The essence of the exploitation plan is to collect and present the exploitable assets of all partners and the project for the expansion of educational and commercial knowledge within and outside the scope of the 5G-Blueprint project. In line with the definition of the European Commission (n.d.), the term exploitation is defined as ‘‘the use of results for commercial purposes or in public policymaking’’. Hence, the exploitable assets of the project and consortium partners are the (expected) final commercial and/or policy-related products that help the project and beneficiaries to develop, increase or expand their commercial and/or public policymaking activities at the end the 5G-Blueprint project as a result of the performed activities during the project.

As part of the 5G-PPP community, the 5G-Blueprint project stimulates the development of 5G-based (teleoperated) services within and beyond the European Union. The project envisions to design and validate a technical architecture and a business and governance model for uninterrupted cross-border teleoperated transport based on 5G connectivity. As such, the forthcoming exploitable assets of the project are the results of this particular scope. In accordance with specific and temporary knowledge about the use of 5G for teleoperated (TO) transport in cross-border settings, this exploitation plan contains individual and project-wide exploitable assets with a direct link to the logistic supply chain. Moreover, limited additional information is presented for the allocation of the project in the wider context of 5G telecommunication. Sections 2.2.1. and 2.2.2. of this document provide more detailed information about the different programmes and projects similar to the literature-review of D3.2.

5G-PPP projects that directly relate to Connected and Automated Mobility (CAM) services based on 5G telecommunication are for example 5G-Med, 5G-tours and 5G-rail. These projects share a focus on the cross-border deployment of CAM in a 5G-setting. Yet, they differ in approach and site. 5G-med advances 5G-based services through examining Cooperative CAM (CCAM) and Future Railway Mobile Communications System services (FRMCS) on the cross-border of Spain and France, 5G-tours aims for researching large-scale realistic operations in the Baltic region in order to realize seamless functionality and 5G-rail investigates the standardization of FRMCS as the 5G-standard for worldwide further deployment. In addition, the projects 5G-MOBIX, 5G-Carmen and 5G-CroCo are more within the scope of the 5G-Blueprint project by putting 5G CCAM for road transport central to their projects. 5G-MOBIX is concerned with research on automated vehicle functionalities, while using 5G-technology, with the goal to develop use case deployment scenarios. 5G-Carmen focusses on the realization of a multi-tenant platform for especially the automotive sector in the normative context of enabling self-driving cars to be part of CCAM. 5G-CroCo researches the potential of one path/direction for the deployment of CCAM services along cross-border environments. The key immaterial value proposition of these projects to the 5G-blueprint project and vice versa is that the cross-border investigation of 5G-technology deployment offers a confidence in 5G-telecommunication sufficiently supportive for enhancement of technology, business, governance and regulatory features specific for multiple CCAM services as for the deployment of 5G-based services in general. The exploitable assets presented in this exploitation plan are therefore of importance to the wider debate on 5G-deployment and can be used to shape existing or innovative narratives.

The narrative of the 5G-Blueprint mainly focusses on finding a blueprint for cross-border, teleoperated logistics based on 5G-telecommunication. The findings of deliverable 3.1 point out that this blueprint consists of many aspects and even more parties that are obliged to or willing to cooperate. In summary, the findings of deliverable 3.1 suggest that 5G-based teleoperation can be a valuable and an accelerating phase for achieving full autonomous vehicles, with the teleoperator taking over the formalities of a regular driver, but it still faces many challenges in the context of this transition. The teleoperator-to-vehicle ratio (TOV-ratio) seems the most

promising tool for estimating how logistic companies can benefit from the deployment of 5G-based services. On the other hand, their financial gain is dependent on other logistic services where 5G-solutions still need to be designed or are running ahead in small-scale deployment phases. The four use cases of 5G-Blueprint (automated barge control, automated driver-in-loop docking functionality, Cooperative Collision Avoidance System based platooning, remote take-over operations) in cooperation with their enabling technological functions (see section 4.2) form the entry points of research in which the benefits and challenges are and will be explored during the project. An interesting first view of the motivations, and related benefits, of all the initial consortium partners is examined at the beginning of WP3. This initial conducted research used surveys for exploring the reasons why the beneficiaries joined the 5G-Blueprint project. The table below contains all these motivations on a rather abstract level, but the table contributes to the understanding of the direction and size of expected development patterns in which exploitable assets emerge.

Motivation/expectation	Mean score
Evaluate the benefits of using 5G and include 5G into existing solutions	4.3
Contribute to societal challenges: safety	4.3
Contribute to societal challenges: others (e.g., traffic efficiency, environmental issues)	4.3
Contribute to societal challenges in the logistics sector	3.9
Validate (connectivity and/or automation) technology	3.9
Explore new business cases based on automation/teleoperation	3.9
Strengthen international exposure and commercial prospects	3.9
Test current solutions through pilots to optimize and develop them further	3.8
Engage in new collaborations with research and business entities	3.8
Contribute to societal challenges: accessibility of mobility services	3.7
Foster technology adoption	3.6
Find new business models	3.6
Clarify costs and benefits of CAD and 5G infrastructure	3.6
Bring clarity about the technological and business feasibility of teleoperation	3.6
Clarify value networks and potential partners	3.5

Motivation/expectation	Mean score
Learn about the possibilities of remote control	3.4
Define governance models for data sharing	3.4
Develop new products/solutions	3.4
Disseminate technical results from real-life testing	3.4
Adapt current solutions to CAD	3.3
Define governance models for cross-border roaming/continuity of (connectivity) services	3.2

Table 10 Motivations and expectations of the 5G-Blueprint consortium (5-point scale)

The collected data emphasizes the importance of revealing the exploitable assets derived from the 5G-Blueprint project from the perspective of the individual partners as the project as a whole. The following paragraphs outline the exploitable assets more in-depth. It is necessary to recognize that this document is drafted 18 months later than the start of the project and, therefore, may not provide desired detailed answers to questions about joint or individual exploitation plans since the made progress is insufficiently useful for detailed elaborations.

4.2 Joint exploitable results

The made progress within the context of the project is yet unable to unravel all the exploitable assets of the project in a detailed manner. On the other hand, the technological, business, and regulatory objectives shape the context in which the exploitable assets emerge as the objectives may be exploitable assets themselves. In case of technological objectives, the four goals are:

- Design and implement a 5G-network for CAM (Connected and Automated Mobility) services with stringent requirements on latency, handover time, reliability, packet loss, and throughput
- Tailer and implement the prototype of a teleoperated system
- Implement and deploy enabling functions guaranteeing the safety of teleoperated transport
- Validate the end-to-end teleoperated transport solution supported by 5G in real-life scenarios in cross-border conditions

For technological objectives, more detailed enabling functions have been outlined which give more in-depth insights into the realization of exploitable assets in the context of logistic supply chain management based on 5G TO. These enabling functions are enhanced awareness Human-Machine Interface (HMI), vulnerable road user's interaction, timeslot reservations at intersections, distributed perception, active collision avoidance, container ID recognition, Estimated Time of Arrival (ETA) sharing and scene analytics.

From the viewpoint of the business objectives, the aforementioned use cases provide interesting grounds for further research on exploitation opportunities. As such, the business objectives are:

- 5G teleoperated transport market analysis
- Commercial possibilities

- Position the possible role of teleoperated transport based on 5G
- Teleoperated transport based on 5G connectivity market adoption

The main and sole regulatory objective is to identify regulatory issues pertaining to the deployment of cross-border teleoperated transport based on 5G-connectivity and recommend actions.

While the intended individual exploitable assets will mainly derive from these objectives and related activities, it is worth mentioning that the outcomes of 5G-Blueprint as a project can become the input for follow-up projects in logistics and other CCAM services. This already triples down to the organizational body of the project including all the different expertise's and how much organizational capacity may be needed to come to a functional working logistic system based on 5G TO. In this view of 5G-Blueprint being an exploitable knowhow platform, the five following project-wide exploitation strategies seem to be fit for future commercial and policymaking development.

Joint exploitation strategies	
Strategy	Reasoning
5G-Blueprint as a constitutional regulator and accelerator, specifically for Belgian and Dutch TO logistics deployment and upscaling	The Belgian and Dutch regulatory context in combination with specific TO logistics provides fruitful grounds for further TO logistics deployment and upscaling, particularly in these countries based on nation-specific gained experience and knowledge (see e.g., article 9.7 in deliverable 3.1)
5G-Blueprint as an engine for further European 5G TO logistics deployment	The wider development of 5G across European borders and the geographically divided presence of logistic hubs and networks benefit from innovative catalysts such as the 5G-Blueprint project. The small-scale deployment of 5G-Blueprint can form an initial starting point for multiple logistic sites and therefore serve as an engine (see e.g., WP4 and deliverable 3.1).
5G-Blueprint as a benchmark for worldwide 5G TO logistics deployment	The gained technological, commercial and regulatory knowledge of the 5G-Blueprint project can serve as a reference framework for other countries around the world. This can accelerate logistic flows (see e.g., 5G-rail).
5G-Blueprint as a knowledge provider for wider implementation of 5G TO logistics within (multi-modal) CCAM	Aside from facilitating TO logistics, the results of 5G-Blueprint are in line with broader developments of 5G, TO, and CCAM. The project's scope on logistics can, as a result, enrich other national or European 5G, TO, or CCAM projects. It can

Joint exploitation strategies	
	be the knowledge provider for national or European roadmaps (see sections 4.1 and 9.8 in deliverable D3.1).
5G-Blueprint as a substantive technological driver for further 5G (TO) CCAM standardization methods	The pilots and use of newly developed CCAM standardization methods can strengthen technological and regulatory debates on what type(s) of CCAM standardization methods are desired and should be enforced (see e.g., 4.1 and WP6).

Table 11: 5G-Blueprint joint exploitation strategies.

The defined strategic exploitation pathways will be further explored and foreseen with more detailed information during the second half of this project. The ongoing trial activities do not constitute a justified foundation for joint strategic exploitation claims, and to avoid speculations, the outcomes will be reported in D8.4 Final Dissemination, Standardization, Exploitation and Joint Activities Report. The development of the Radar Innovation Questionnaire (see 4.4) assists in this respect and pinpoints practical directions which can relate to the joint exploitation strategy.

4.3 Individual exploitable results

Based on the beneficiary's type, i.e., MNO, logistics and transport company, SME, or university, each partner has identified its potential exploitable assets taking into account the following components: name of the exploitable asset, type of asset, ownership, related WP, customer target group and problem, customer benefits, competitors, differentiating aspects of the asset and, if applicable, the initial and final expected Technology Readiness Level (TRL). Consortium partners have been asked to provide more specific details of their exploitable asset(s) by means of these components. This paragraph will further outline the exploitable assets and respective components in a descriptive manner. As D8.3 is a living document, the expected individual exploitation plans will be revised during the project when a following phase is reached. The individual exploitable assets confirmed in this paragraph are handed before M18. The next exploitation plan will be presented at M36.

4.3.1 National governments (ministries and road operators)

Ministry of Infrastructure and Water Management (including Rijkswaterstaat, and with support of Agentschap Telecom)

The goal of the Ministry of Infrastructure and Water Development (MIW) in all its activities is to improve the life of the Dutch citizens. Hence durable deployment is our key driver. Therefore, MIW will continuously attempt to stimulate the broad adoption of the most promising results of this project. This means that on one hand MIW will try to use this project as a leverage for the initiation of other national and international activities in the field of CAM. On the other hand, MIW will also facilitate the later deployment and exploitation of the delivered 5G-Blueprint results as much as possible (both related to WP3). A non-exhaustive list of corresponding activities is initiating the necessary updates to legislation, investigating possible financial or fiscal measures to stimulate adoption, etc. The core exploitable asset MIW aims to formulate after 5G-Blueprint is TO roadmap for the Dutch government.

The 5G-Blueprint project is bringing a lot of realism to the hype that has surrounded 5G and CCAM over the last years[11]. Based on current lessons learned in the project, it is clear that these topics have gone beyond the Peak of Inflated Expectations but will also not stay at the Trough of Disillusionment of the Gartner hype cycle[12]. MIW is confident that the Plateau of Productivity can be reached, and that 5G-based teleoperation can be made to good use in specific (blueprinted) deployment scenarios and corresponding conditions. But to make this a reality, the public sector will need to take specific actions after the end of this project to facilitate an actual deployment. The overview of these actions, identified as part of this project and called the Dutch government teleoperation roadmap, form the basis for the Ministry of Infrastructure and Water management to continue working on its responsibilities and core activities in this domain. This plan of action is deemed necessary, because if the government does not take up its own responsibilities, 5G based teleoperation cannot be deployed. Collaborative efforts with regards to the development of this governmental teleoperation roadmap need to be discussed. MIW suggests a collaboration with MOW while also cooperating with national and regional governmental bodies. The exploitation plan is foreseen in deliverable 8.4.

Department Mobiliteit en Openbare Werken

The project approaches and overall outcome will be presented and discussed – regarding an optimal use of existing capacities and where the exploitation of the fibre network, (support to) the roll-out of a 5G infrastructure and (public works related) investments plans are on the table. The department Mobiliteit en Openbare Werken (MOW) plans to assess opportunities to maximize return on investment, in particular in relation to public-private co-operation in the field of CAM and the roll-out of 5G enabling infrastructures. MOW envisions three exploitable assets.

The first exploitable asset is the ‘Antwerp Smart Highway test site’. The 'Antwerp Smart Highway test site' is composed of (1) sensors, cameras, and roadside telematics devices (Virtual Memory Size/Resident Set Size) feeding data processing and run-time type information (RTTI) generating modules under control, and (2) RSU and V2X communication modules (controlled and operated by imec) interconnected using MOW's fibre network (related WPs are 4, 6, and 7). The hardware and software are single partner proprietary (HW & RTTI modules operated by TIC Flanders (the national regulatory authorities) created with the purpose of support testing/ validation of innovative communication technologies and -potentially- active directory functionalities (including TO) for road users. There are no competitors in Flanders yet and the differentiator is the real-life validation of concepts and business model options. The exploitation plan can be found in D8.4.

The second exploitable asset is called 'MOW's fibre network along highways and waterways. The fibre network monitors hardware and manages modules. It is meant to support the set-up of 5G-infrastructure networks which are required for testing/validation with the goal of supporting 5G-rollout. Related WPs are WP5 and WP7. The expected, and license-based, customers are data/communication network operators. Competitors are commercial fibre network providers and differentiators are neutral use/ contract; liability issues incl. service level agreement to be agreed. The exploitation plan is foreseen in D5.5/D5.6.

The last exploitable asset is a teleoperation roadmap for public authorities and commercial players (ports, MNOs, freight forwarders, etc.). This (internal) roadmap is potentially covering/co-owned by NI-FI and open for wider use (tbd). With the help of the progress made in WP3 and WP4, societal benefits can be achieved (e.g., better use of existing (road) capacities and/or human resources available). However, Port of Antwerp has to carry out its (dedicated) part of the roadmap. No competitors were identified. The differentiator is a set of actions that

[11] https://www.techtarget.com/searchnetworking/feature/Gartner-report-provides-reality-check-on-the-5G-hype
[12] https://www.gartner.com/en/research/methodologies/gartner-hype-cycle

needs to be realized for 5G-based teleoperation to function. The exploitation plan is captured in deliverable D3.5.

4.3.2 Universities and research institutes

imec

imec will advance regarding experimental validation of innovative 5G-based V2X communication technologies, which is relevant for imec's research activities as well as for its industrial partners. The knowledge and expertise gained from 5G-Blueprint will be very relevant to extend imec's Smart Highway testbed capabilities with 5G technology. imec's Smart Highway testbed – being deployed in the area of Antwerp – is an important asset for both the research community and industrial partners including telco operators, network equipment vendors, car manufacturers, and application developers. In this case, 5G-Blueprint will be an enabler to position imec as an important hub in research and validation of 5G and CAM and it will help imec to set up future projects with industry, especially for validation and feasibility testing, rapid prototyping and commercialization. It could also be exploited by establishing spin-off companies through imec's Incubation & Entrepreneurship programs. Related WPs for the exploitable assets of imec are WP4, WP5, WP6 and WP7.

The Smart Highway 'IMEC's V2X Testbed (Vehicle-to-everything (V2X) roadside units (RSU's) and onboard units (OBU's)' is the first exploitable asset of imec. The Antwerp Smart Highway test site is being built on the InterCor Belgium/Flanders (CEF Action 2015-EU-TM-0159-S) 'C-ITS test site' on the E313 highway. The purposes of the Smart Highway are to test different use cases related to the highway scenario in real life settings and to conform the connectivity aspects of the experiment to the current ITS standard. Currently, there is not much open road-testing track which supports multiple V2X technologies on Highway. The testbed supports multiple Radio Access Technologies, can provide precise positioning and have higher computational power. As proprietary of imec, other research institutes are seen as competitors. The target groups are research organizations and universities, OEMs and Telco operators. The exploitation plan of the Smart Highway is presented in deliverable 5.5, deliverable 5.6 and deliverable 7.4. The initial TRL is 6 and the expected TRL is 8.

The Local Dynamic Map and C-ITS Messaging Framework is the second exploitable asset of imec. The application allows the connection to the On-Board Unit of a car that could display in real time, relevant information regarding the traffic situations. It will help drivers to get insights of the road environment. At the moment, there are not many applications that can translate standardized ITS messages using V2X technologies. The key benefit is that users can view the messages transmitted using V2X communication modules in a user-friendly interface in real-time. The end-goal of imec is to create an application that is easy to use and cross-platform. Also, this exploitable asset is owned by imec and targeted for research organizations and universities, OEMs and Telco Operators. The exploitation plan of the Local Dynamic Map is foreseen in deliverable 7.4. The initial TRL is 4/5 and the expected TRL 8/9.

HAN University of Applied Sciences

HAN will try to use the learning outcomes of the projects within the curriculum of its bachelor and master program of intelligent mobility to keep the students up to date on the technological reforms and the benefits of 5G technology (WP4). Some of the research within this project will be performed alongside the students thereby providing a good exposure to the students of the upcoming technology. The learning outcomes from this project will be used as a base for current and upcoming projects where HAN will participate in.

The key exploitable asset is educational material in the module of Intelligent Mobility for the transformation of project learnings and results into a number of lectures/workshops, which will be integrated into the module of Intelligent Mobility. The educational material will be part of HAN and V-Tron. At the moment, there is a lack of educational content on the topic of teleoperation and 5G connectivity technology. The project learnings and results serve as valuable lecture

material which prepares the student to the up-to-date needs of the industry. Hence, the target groups are bachelor and master students and the competitors are other universities. The differentiator is the exclusive content-based field results. The exploitation plan is presented in deliverable 6.4.

HZ University of Applied Sciences

The results of the project are used in applied research and deployment projects at request of logistics service providers in the region of Zeeland. In order to adopt these technologies, logistics companies might need to change their business models, their logistics operations and their human capital capabilities. HZ will support logistics service providers, especially SMEs in the process of identification of the opportunities and required changes by means of student projects (internships and graduation projects of bachelor students) and working groups in which knowledge is shared between logistics service operators that are preparing for adoption of these technologies. In the Zeeland region, approximately 50 transport companies based in the region will be supported over the next 10 years.

In more detail, HZ is focussing on three explicit exploitable assets related to WP8 and WP3 (last exploitable asset). First, a minor course about automated and teleoperated driving in logistics, created within the project, which can be continued in the future. The lack of educational materials and courses on these topics is accelerating HZ to create this course without the involvement of other universities.

The second exploitable asset is: Massive Open Online Course (MOOC) about automated and teleoperated driving in logistics (online version of the minor course). In contrary of the minor course, the MOOC is for universities, research institutes and companies. The course has been planned but the specific content and ownership of the course still need to be discussed as there is no proposed deadline for finishing this MOOC. Both assets are expected to be part of a continuous adaptive exploitation.

The last exploitable asset of HZ is different from the previous two since it considers a methodology including a model. HZ attempts to realize a simulation model to estimate teleoperator-to-vehicle ratios in different scenarios. The goal is to achieve insights on optimal teleoperator-to-vehicles ratios because there is currently a lack of knowledge about teleoperated planning. The target groups for the simulation model are universities, research institutes and companies. Follow-up studies, next to the studies in 5G-Blueprint, will contribute to a better understanding of teleoperator-to-vehicles ratios.

4.3.3 Ports

North Sea Port

Because companies Kloosterboer, Verbrugge, and MSP are already active in the port, they are also interested in setting up their business (technology) there. The port acts as a director, bringing together interested and mutually complementary parties and facilitating cooperation between them. The first step will be focused on optimization of road transport (with this call). It is important that 5G and the call provide the possibility to widen up the proven technology, business models, and governance to the other multimodal transport solution (barge, rail).

North Sea Port aims at developing four exploitable assets. The first exploitable asset is the combination of know-how / knowledge / domain-info for educational internal purposes. The asset encourages LnL's and deliverables from the project as input into internal processes and/or related projects and familiarity with challenges, opportunities and terminology related to a niche-domain within connectivity as input for the port-ecosystem. With this methodology, potential bizz-model, and terminology, North Sea Port focuses on companies within the logistic supply chain that are dealing with port-related transport. For example, port authorities, road authorities (combination of), communication with OEMs for connectivity, vehicles/vessels/drones, etc. Public companies and authorities need to get familiar with the possibilities and challenges that

private companies are facing in the niche of connectivity and autonomous transport/mobility. By understanding each other better, we could establish a common ground/interest to implement new technology in order to make the port-ecosystem more future-proof and relevant. A new set of rules and governance will be required to boost commercialization. The benefits are (1) knowledge of the niche and the players to fully understand the challenges and advantages autonomous transport could bring and (2) understand where port authorities could help/assist to push towards a more sustainable supply chain that is ready for future challenges. This asset helps to expand commercial and educational activities. Related WPs are WP3, WP4 and WP8.

The second exploitable asset of North Sea Port is called land/space. 5G connectivity will require (more) space/land/assets (then 4G) in order to enable teleoperation. Secondly TO will require space, preferably in the vicinity of the main ops, certainly in ports. The customer target groups are companies within the logistic supply chain that focus on port-related transport, port authorities, road authorities (combination of), communication with OEMs for connectivity, vehicles/vessels/drones, etc. Related WPs are WP3, WP4, WP5 and WP7. The defined customer problem is that multiple 5G-transmittors are required for sufficient coverage of an area. Organizations use their own or partner land to install connectivity assets. North Sea Port can provide or help to find an appropriate space for a TO-tower (temp and permanent), which would allow to temporarily use land for setup and testing, connect existing parties with new players in this field. Etc. The benefits are again (1) knowledge of the niche and the players to fully understand the challenges and advantages autonomous transport could bring and (2) understand where port authority could help/assist to push towards a more sustainable supply chain that is ready for future challenges.

The third exploitable asset is goodwill and support in the port ecosystem. 5G connectivity and teleoperation or autonomous transport will need to be well explained. The advantages need to be clarified toward authorities, end-users, operators, transport companies, and citizens, etc. The possible disadvantages need to be anticipated on by the niche-experts, highly technical matters need to be translated into common language, understandable to the general public. This joint and connecting type of immaterial data is especially interesting for the port community, the general public and (local) authorities. There is a lot of fake news regarding (1) 5G or future 6G connectivity, e.g., 5G is reason of COVID. (2) Robotics, autonomous, teleoperation are taking away jobs, unions claim this means job loss for many workers, drivers and operators active in and around the ports (and beyond). Unions will try to stall or stop this trend because of unreliability and or risk for cybersecurity. Also, port companies will not risk the automation of everything, they need to be able to deliver in case of example a power-outage (or network-outage). Including knowledge of the niche and the players to fully understand the challenges and advantages autonomous transport could bring and understanding where the port authority could help/assist to push towards a more sustainable supply chain that is ready for future challenges. Related WPs to the exploitable asset of goodwill and support in the port-ecosystem are WP3 and WP8.

The last exploitable asset is data. The question is what (big)data can and will bring the port community, how can data be used, and what are the major threats related to using it. The target group here is the port authority and its community. There is insufficient knowledge of the possibilities that big data can bring to a safe and secure, but also very conservative part of the supply chain. The benefit of exploiting this asset is to gain knowledge in order to enable innovation in a community. Do we want/need a digital twin? What is required for autonomous operations? The exploitation is therefore both commercial and educational. WP3 and WP8 are related to this exploitable asset.

Port of Antwerp

The knowledge gained in this project will be exploited internally and externally. Internally by integrating it in the future employment of technology and externally in our different discussions with stakeholders and for future projects. The key exploitable assets of the Port of Antwerp are educational material and educational courses. Port of Antwerp wants to take the project learnings of 5G-Automated and teleoperated driving into courses and/or workshops for port

authorities and related port companies. Besides, these gained information increases of course the knowledge within the organization itself. The issue at hand is that there is a substantive lack of knowledge about the project topic and Port of Antwerp wants to use this knowledge for further deployment and pushing companies towards teleoperated driving. The ownership of the educational material and educational courses is determined single partner and WP8 is the related WP.

4.3.4 Mobile network operators

KPN

KPN will use the outcomes of this project in any ways possible, but especially for all sites near the borders. KPN expects this project to come up with clear technical and governance guidelines on how to design, deploy and configure the different network components in such a way that KPN can reuse the outcomes on its entire network.

Telenet

Telenet will use the results to build new technology strategy and ecosystem agreements. Utilizing its sales, integration and field force will provide new services to the market. Starting with existing logistic and IoT customers to all IT empowered verticals. Telenet will also build other R&D activities with universities/institutions based on the work of this project.

4.3.5 Infrastructure operators

Eurofiber

Eurofiber is always working towards the successful roll-out of new network technology and its primary goal is to help maintain the unique position of the Netherlands in the Digital Society, bringing about fundamental changes to our society, shaping our future. The research- and development results of this project will be used to further the design and roll-out of new, suitable backhaul- and connectivity propositions that will be at the heart of the Dutch and Belgian 5G-fiber-core infrastructure of tomorrow. Eurofiber will try to use the project collaboration and the 5G-Blueprint results to initiate and deploy new joint MNO and Government strategies, leveraging an efficient and cost-effective way to build the vital foundation on which the national and international 5G networks are built. Eurofiber will initiate the definition of governance- and business models and, as a neutral host, investigate possible joint ventures, further enabling the use of existing and new network solutions accommodating the digital transition.

4.3.6 Automotive OEMs

TME

TME will exploit the knowledge and experience gained through the project internally to enhance its research and development activities in the field of autonomous vehicle and vehicle communication technologies i.e., V2X, to realise even better vehicles keeping safety and quality in mind. The exploitable asset of TME is purely educational material. The proprietary educational material will include following topics (i) introduction & state of the art of 5G, CCAM and teleoperation topics and (ii) communication technology & overall teleoperation performance assessment. The related WPs are WP4 and WP5 and TME is the single owner. Currently, TME addresses that there is a lack of educational content on the topic of teleoperation and 5G connectivity technology. For OEM research centres, they aim to expand their knowledge on these topics and give lectures. In doing so, the differentiator is internal availability, directly targeting internal divisions and up-to-date and accurate information. The sole focus of the exploitation is thus on education and research.

4.3.7 Teleoperation OEMs (both on road and on water)

V-Tron

V-Tron is working on the implementation of 5G platforms for autonomous mobility at the Port of Rotterdam and on Dutch multimodal transport domains (road, airways, and waterways). V-Tron has seven exploitable assets which are all part of WP4 and do not contain an initial TLC. The exploitation plans of the individual assets are foreseen in deliverable D4.3.

The first exploitable asset is a teleoperation interface with regards to car use. The hardware and software platform package will be developed by the company itself for OEM's and teleoperation service providers. For OEMs, as a tier 1 supplier to enhance teleoperation functionality for their vehicles as a single point of disclosure for internal vehicle architecture, and, for service providers, as the results of lacking automotive knowledge which can be bridged via this platform. The key benefit is direct integration. The platform provider, in this case V-Tron, will make sure the OEM does not have to invest anything additional in teleoperation research and that teleoperation service providers can build their system independent of the vehicle model. This competes with other tier 1 suppliers but V-Tron differentiates by means of modularity and platform independence. The final expected TLC is 7.

The second exploitable asset of V-Tron is a CACC-TO platform, which serves an automation layer for teleoperated vehicles. Again, this is a hardware and software platform package for OEM's and teleoperation service providers with the same further characteristics as above. It is worth mentioning however that V-Tron notices that teleoperation business can be more interesting for service providers by including automation and the final expected TLC is 6.

The third exploitable asset is a teleoperation interface for trucks. The interface is used to integrate teleoperated hardware for trucks. The hardware and software platform package shares the same conditions as the first and second exploitable assets. The final expected TLC is 6.

The fourth exploitable asset is a scaled platform with sensor suite and vehicle-to-vehicle communication (V2V). This is a development platform with sensor suite and communication unit for research and development. Organizations and universities which are searching for the development and testing of automated vehicle systems can use this platform to validate and optimise their algorithms. The system will offer physical validation of system without having to invest additional resources and time into hardware development. Competitors are scaled platform developers. Differentiators are modularity and close to full scale vehicle network architecture and protocols. The final expected TLC is 5.

The fifth exploitable asset is an on-board unit for V2X communication with C-ITS stack for multiple applications. Target groups are OEMs, Tier1's and research institutes which aim to develop C-ITS use cases based on V2X communication. The system will offer a modular platform for C-ITS development without having to invest additional resources and time into hardware and backend development. Other C-ITS product developers are seen as the competitors. The differentiators are a single source for hardware and software platform. The final expected TLC is 6.

The sixth exploitable asset is a testing platform, with the vehicles prepared for 5G-Blueprint, for new use cases with teleoperation and automation. This service is meant for OEMs, Tier1 and research institutes which are willing to develop new use cases and new teleoperation systems while using the platform as a service to test future scenarios. The system will offer physical validation of system without having to invest additional resources and time into hardware development. Competitors are other Tier1's and differentiators are modularity and platform independence. The final expected TLC of this exploitable asset and the following is 7.

The last exploitable asset of V-Tron is an advisory and consultancy service for developers (OEMs, Tier1's and research institutes), building teleoperation and automation systems based on 5G-Blueprint experiences. The key benefit is advice on technical developments based on the knowledge gained during the 5G Blueprint development and experimentation.

Roboauto

The main goal of Roboauto is to contribute to the development of a safer and more socially friendly form of transporting people and goods. Teleoperation is a solution for more efficient transport and optimization of a load of individual drivers in the transfer nodes. Teleoperation is an interesting alternative to normal driving, especially for the next generation. Roboauto plans to use the knowledge from this project to deploy teleoperation in public transport such as trains and trams. Furthermore, based on the results of this project, Roboauto will build the first teleoperation centre to provide remote drivers for logistics operations in ports.

MWLC

MWLC is a start-up company that develops and sells proprietary, patented software that makes autonomous driving at Society of Automotive Engineers (SAE) level 4 possible. Teleoperation is a method for training a vehicle's autopilot and for monitoring a vehicle during auto-pilot operation. The background IP that MWLC is bringing to the project consists of know-how, systems and software that address the training of autonomous vehicles using teleoperation. The first patents have been granted in Europe and commercial exploitation through IP licensing arrangements is a target. The 5G project focusses on higher speed applications which is where the development of MWLC needs to focus. Our existing and likely new IP appears particularly relevant in the light of the technical discussions in the 5G-Blueprint project about using the teleoperation on complicated sections of a route and (more) autonomous approach on the simpler sections (WP4). This is driven by technical network considerations. The learnings and outputs from the project will be incorporated in our product development and commercialization strategy targeting markets beyond those of the project, in particular the market for freight transport using networks of small autonomous vehicles.

The first exploitable asset of MWLC is a software code on GitHub, https://github.com/cadenai/byodr. The software code is initially used as background IP to the 5G project, but this scope is expected to expand as a result of the project. The software enables routine unmanned logistics and surveillance, including teleoperation. The target groups of interest are universities, research centres and commercial clients. The goals are emission free transport, opportunity for unmanned transport and cost-savings. A competitor is Wayve.ia and the differentiator of MWLC are: technology using only visual information as input for driving unmanned vehicle, much more cost effective than sensor fusion approach to autonomous driving and collecting more data that improve underlying deep learning models when deployed. The initial TRL is 7 and the final expected TRL is 8.

The second exploitable asset is manuals and hardware designs on https://byodr.readthedocs.io/en/latest/. The manuals and hardware designs are initially used as background IP to the 5G project, but this scope is expected to expand as a result of the project. The open-source hardware enables routine unmanned logistics and surveillance. The target groups are universities, research centres and commercial clients. Also, the manuals and hardware designs attempt to trial technology through quick deployment and assess scope for and feasibility of realization of benefits such as Emission free transport, opportunity for unmanned transport, cost-saving. The currently used vehicle was designed out of a perceived shortage in the market. There are many companies capable of delivering a suitable vehicle ONCE market demand is proven. Differentiation of the asset is provided by means of easy access and opportunity to use highly innovative technology. The initial TRL is 7, based on open-source designs, and the final expected TRL is 8.

The third exploitable asset is patents regarding training for autopilot using teleoperation to enable unmanned routine logistics and surveillance. MWLC can provide licenses to universities, research centres, commercial clients with hardware (vehicles), but not software to enable teleoperation and autonomous driving. They key opportunity is to license IP. The background IP regarding the project is going through prosecution.

The last exploitable asset of MWLC is knowhow as proprietary tool for the assessment of ODD. Parties can apply for the use of vehicles that is subject to specific permits that require analysis of the ODD on public road. The target group is therefore parties that can apply for permits to use teleoperated and/or autonomous vehicles on public roads. The benefit is a structured analysis of ODD as basis for/part of permit application. Competitors are still unknown and the initial TRL's vary (3,4 and 8). The final expected TRL is 8.

Seafar

If successful, the 5G solutions will provide a base for cross-border operations with remotely operated vessels and so open the routes between Belgium and The Netherlands for unmanned vessels. The 5G solutions will be the base for the expansion of operations for unmanned waterway transport and provide an answer to the lack of coverage and latency that remote controlled vessels are facing today. Seafar will use the result gained through the project to enhance its R&D activities in the field of autonomous ships communication technologies for V2I and V2V. This will ensure the safety of the ship and the environment in which the ship operates. In addition to safety, efficiency of the communication will be assessed.

4.3.8 Application provider for vulnerable road users

Locatienet

Locatienet will promote the developed awareness functions among vulnerable road users through social media campaigns and PR (WP6). The functionality will be made available as a white-label product to app developers, bicycle manufacturers, last mile service providers and OEMs. The first exploitable asset is a V2X exchange service. This software and proprietary asset are needed because there is no solution available to efficiently exchange V2X messages between road users and infrastructure assets with ultra-low latency using 5G. The goal is to ensure exchange of V2X messages between road users and infrastructure objects for road Authorities and TLC providers. The service can be deployed as cloud service or on the 5G edge with low-cost and low-latency. Their sole competitor is Monotch.

The second exploitable asset is a collision detector, which is a software and proprietary asset. At the moment, there is no solution available to determine collision risks based on V2X messages. The goal is to receive warnings for potential collision site/time of road users. The target groups for a collision detector are app developers and OEMs. Locatianet distinguishes itself based on low-costs, low-latency, and deployment in clients' services. There are no competitors found yet. Both the exploitable assets have an initial TRL of 4/5 and a final expected TRL of 6/7.

4.3.9 Application and service providers for logistics

Sentors

Sentors aims to develop a disruptive, company-owned solution, where a low-end camera in combination with a 5G subscription allows container recognition to be offered in a "plug-and-play" fashion that only requires to mount a camera, 5G modem, and to provide electricity. This becomes feasible when there is no longer a need for local hardware that continuously analyses the video stream, but rather the machine learning algorithms can be deployed remotely and centrally (WP6). The solution can be used on any barge terminal (at gates, cranes, and reach stackers), empty depots, warehouses and other premises that handle containers. The Sentors concept itself is widely applicable also beyond containers, so Sentors aims to promote its competencies in the field of image recognition using machine learning at European level.

Many smaller/medium-sized businesses have the need to automate their processes by registrations of the ingoing and outgoing containers but lack a proper ICT infrastructure. Likewise, public roads lack such infrastructure when road operators want to count containers and dangerous goods passages. The exploitable asset 'Sentors' is therefore a solution with low installation and maintenance costs next to being a scalable solution that can be applied at

several/many parts in the business process. Competitors are existing container scanning solutions, currently mainly used at larger seaports. The exploitation plan still needs to be announced, but the desire is to TRL 4/5 to TRL 8/9.

Room40

It is the intention of Room40, together with its platform partner Nokia, to demonstrate the need of real-time streaming solutions for mobility, security and public safety (WP6). The 5G technology enabling these streaming solutions will be used as key differentiator internationally. Deploying solutions in real time and only when they are relevant for the user can only be achieved by using the 5G technologies. Therefore, Room40 will support activities disseminating this, and deploy the use of 5G technologies underneath its own solutions.

The first exploitable asset of Room40 is a self-made Scene Analytics Platform, which is a real-time multimedia feed analytics and anomaly detection platform. Currently, the industrial companies experience a lack of relevant real-time information and the Scene Analytics Platform provides this. The platform distinguishes itself with anomaly protection. Competitors are other video management systems and IoT solutions.

The second exploitable asset of Room40 is a 5G-hub. The purpose of this self-made hardware platform is to physically host processing hardware and 5G equipment for Telco's. There exists a lack of on-premise hosting environments and processing capabilities. The 5G-hub supports a local edge processing unit with 5G capabilities that is elegantly integrated into industrial and urban settings. No competitors have been identified.

NxtPort

NxtPort is offering an innovative, secure data sharing platform to drive digitalization in port logistics and global supply chains. The APIs developed in this project will be placed at the NxtPort Market place (https://www.nxtport.com/market/our-marketplace/marketplace) and will be made available for the whole community. These API's can then be used by (independent) software vendors for use in their software solutions, or directly implemented in the software of port-related companies (e.g., terminals, shipping agents, forwarders, intermodal suppliers, etc.).

4.3.10 ITS service providers

Be-Mobile

Be-Mobile aims for the development of C-ITS and logistics functionalities which will be integrated in an existing or new product offering, available for use to external and internal customers (WP6). The exploitation plans still need to be announced, but the first exploitable asset of Be-Mobile is a truck route planner including turn-by-turn navigation and Estimated Time of Arrival (ETA). The advancements developed and piloted in 5G Blueprint with respect to route planning, specifically for truck transport, and determination of an appropriate ETA in real-time, taking into account various other sources, will be used to improve Be-Mobile's own route planner. There is a need for reliable real-time route planners that consider constraints imposed by truck transport. The goal is an improved route planner and ETA which explicitly accounts for constraints imposed by truck transport. Be-Mobile will provide software and a methodology for this. Other providers of truck route planning software are competitors and Be-Mobile differentiates through delivering fine-grained real-time ETA, which takes into account detected obstacles on route (not just real-time travel times, but also whether priority was granted at an intersection). The initial TRL is 4/5 and the expected TRL is 8/9.

The second exploitable asset is long-distance and route-based priority requests at intelligent Traffic Light Controllers (iTLC). Following advancements made during the project, Be-Mobile will be able to request priority over longer distances than before, and this is based on a route provided by the transport for which priority is requested. The target groups are emergency vehicles, heavy-goods transport, public transport for earlier or allowance of priority at intersections, which is not always possible now. Priority can be requested a longer time in

advance (e.g., 2 minutes before). This can allow iTLCs to adjust light phases in time to guarantee fast crossing of the intersection for the vehicle that requested priority. It is deemed that long-distance and route-based requests will give more reliable priority granting. Competitors are other providers of cloud- or radio-based priority services. The initial TRL is 4/5 and the expected TRL is 6/7.

The last exploitable asset is speed advice. The advancements made during the project will allow Be-Mobile to provide more reliable speed advice to end-users; in first place focussing on providing speed advice that allows vehicles to arrive at intersections during a green light phase. Self-owned algorithms support that road users receive a speed advice, which would increase the probability that they have green light at the next intersection. This would reduce emissions and increase road safety. The central issue at hand is that road users normally have to stop in front of a red light even though they adjust their speed levels. Target groups are therefore users of navigation applications and consumers of priority services. The differentiator is that speed advice to the next intersection in the aforementioned context is not done before. Other providers of navigation applications are the competitors. The initial TRL is 3 and the expected TRL is 6/7.

SWARCO

By doing experiences in 5G-Blueprint SWARCO will learn more about the integration between 5G and C-ITS applications and by that SWARCO will be able to explore this in all the countries where Swarco is active. The key exploitable asset is called SWARCO. The asset is a self-owned iTLC concept with ITS-Application as a cloud service accordingly (WP6). The aim is to digitize traffic engineering services as a Cloud Service, because network concepts for road network optimization in larger geographical area's will be much simpler to achieve. The target groups of SWARCO are road authorities, their competitor is RoyalHaskoningDHV and their differentiator is larger volumes in TMaas. The exploitation plan is expected in the third quarter of 2022. The initial TLC and final TLC remains the same - 8.

4.3.11 End-users of the logistics sector (shipping or transportation)

Kloosterboer

The goal of Kloosterboer in this time where (forklift-, tugmaster) drivers are harder to find is to find solutions for this increasing problem. Hence durable deployment is our key driver. We improve the working environment and work for the drivers through automating the steering that is enormously boring and a constant repetition during the day. Through this we optimize the internal traffic, make the work that needs to be done more interesting and improve the working life of the employed drivers. Kloosterboer will facilitate the deployment and exploitation of the delivered 5G-Blueprint results as much as possible on our terminal and in our vehicles. This will be made possible through various projects and pilots.

The key exploitable asset of Kloosteboer is the port environment. Kloosterboer wants to learn how 5G/Automated and teleoperated driving can be used in a port environment and, simultaneously, integrated within daily operations (i.e., Automated Terminal Tractors working together with RTGs, Reachstackers, Mobile Harbour Cranes etc.). This particular knowledge helps Kloosterboer in making the next step in the automation of their container terminal (autonomous or teleoperated driving). Hence, their exploitation is labelled as research. The focus is more on road transport instead of internal terminal transport. Their customer groups are port companies.

Verbugge

Verbrugge will try to use the learning outcomes of the projects within the following sectors: Safer work environment; Business process improvement; Service enhancements; Expansion of project results; Industry assistance on implementation.

ROOSENS

ROOSENS sees a major advantage in the project, for example by using unmanned vehicles for the dock tracking's (e.g., overnight). With this type of transport, a lot of time is lost due to waiting times, one driver could simultaneously operate several vehicles e.g., reachstacker and truck('s).

4.3.12 Specialized support offices

Martel

Martel plans to consolidate its experience and position in the research and innovation context, which will be exploited in several ways. The acquisition of new expertise and knowledge via coordination of the project lead of dissemination, communication and stakeholder engagement activities via WP2 and WP8, will allow Martel to offer new innovation management, consulting and media services in the European and international R&D&I context. The exposure gained through the planned stakeholders' engagement, dissemination and communication activities will allow Martel to become a key player facilitating the take-up of project results by interested industries, SMEs and external actors. Moreover, the acquisition of new expertise and knowledge via close coordination of all project's tasks and lead of several CC-programme strategic coordination activities, will allow Martel to strengthen and enrich the spectrum of services offered to its customers and partners, spanning from innovative media and communications, research and innovation management methodologies and tools, training and events. The in-deep knowledge of the research and innovation ecosystem and funding programmes shape that the present lack of knowledge in EU-funded project management of academia, industry and SME's can be diminished based on Martel's evolving and long-established experience, knowledge and networking competences in the mobility and logistics sectors and beyond.

Impuls

Impuls is highly interested in accelerating the development, deployment and validation of innovative services, as those intended to be developed by the 5G-Blueprint also in concert with the "Autonomous Transport Zeeland" project that aims to explore the possibility of autonomous road transport within the logistics sector of Zeeland. The key exploitable assets of Impuls are consultancy and support (WP4). As organization Impuls / Zeeland Connect is in the middle of the logistic companies in Zeeland. They can help projects to connect themselves to Zeeland and develop collaborations while being a bridge between businesses and governments. This type of valorization can help all logistic companies in Zeeland, universities and governments because there is currently a lack of interest and knowledge among logistical companies in Zeeland about autonomous transport. The key benefit for using the consultancy and support of Impuls is that logistic companies are informed about the possibilities of 5G and teleoperated driving and merging knowledge of the 5G-Blueprint project with the living lab autonomous transport.

4.4 Planned activities

Besides the regular WP and other internal meetings, the 5G-Blueprint project consortium envisions organization of other activities targeting external organizations, including the Advisory Board Members and the members of the ended ICT18 projects and the other ICT53 projects. Chapter 2 of this document outlines the specifications of the wide array of activities that are planned for the remainder of the project. Some activities are more passive (e.g., publication of academic articles and deliverables), whereby other activities are more active and require a certain level of participation (e.g., conferences).

Recently the project submitted the Innovation Radar Questionnaire which includes five potential project innovations that will be the base for further investigations based on the evolution of the project:

1 Teleoperation solutions for trucks and skid steers using 5G

2 Teleoperation solutions for barges using 5G

3 Auto-docking services for teleoperated trucks using 5G

4 Container ID recognition using 5G

5 Scene analytics using 5G

The intention of 5G-Blueprint is to distribute the gained knowledge of the project as much as possible by means of the planned activities described in chapter 2 of this document that will be reported in detail in D8.4 Final Dissemination, Standardization, Exploitation and Joint Activities Report.

5 CONCLUSIONS

The document at hand reported on communication, dissemination, standardization, and exploitation activities conducted in the first half of the 5G-Blueprint project, including progress against the set KPIs, in addition to presenting the plan for the second half of the project.

Having met all communication and dissemination related KPIs despite a challenging situation caused by various pandemic-related restrictions, the project consortium is satisfied with the results achieved by WP8. The various types of promotional activities described in this document will continue to support the successful promotion of the work performed by the project consortium and uptake of its results, benefiting project stakeholders and the extended 5G-Blueprint community.