

Deployment enablers for 5G-based Connected, Cooperative and Automated Mobility (CCAM)

Barriers, Challenges and Recommendations for large-scale deployments
along major transport corridors

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4-6/11/2020



5GMOBIX



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825496

Overview

- Overview of 5G-MOBIX
- Trial and pilot activities
- Barriers and Issues for Cross-Border 5G-enabled CCAM
 - Technical gaps
 - Regulatory & Policy Gaps
 - Business barriers
- Recommendations for technical and regulatory innovations

About 5G-MOBIX

- 5G-MOBIX will **develop and test automated vehicle functionalities using 5G core technological innovations**
- Project results will be tested along **multiple cross-border corridors and urban trial sites**, under various conditions of vehicular traffic, network coverage, service demand, as well as considering the inherently distinct legal, business and social local aspects.
 - **2 x-Border corridors:**
 - Soft border: Spanish-Portuguese CBC
 - Hard border: Greek-Turkish CBC
 - **6 Pre-deployment trial sites:**
 - Finland, Germany, France & the Netherland
 - International cooperation: 2 sister sites in China & South Korea

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Deployment Enablers

- 5G-MOBIX dedicates Work Package 6 to the **analysis of deployment enablers for large scale 5G deployments across major transport corridors**
 - **State of 5G today** (stakeholder, research, patents, projects, market offerings, business models, spectrum harmonization, existing legislation and policy frameworks)
 - **Analysis & Stakeholder input:** Barriers to innovation, cooperation and exploitation with particular focus on **cross-border issues**, Recommendations for necessary technical, cooperation and regulatory innovations needed
 - **WP6 has provided extensive analysis across its 4 tasks, with 106 barriers identified and 173 recommendations**
 - Full analysis will soon be available in the [5G-MOBIX website](#), Deliverables D6.1-D6.4.

State of 5G - Research

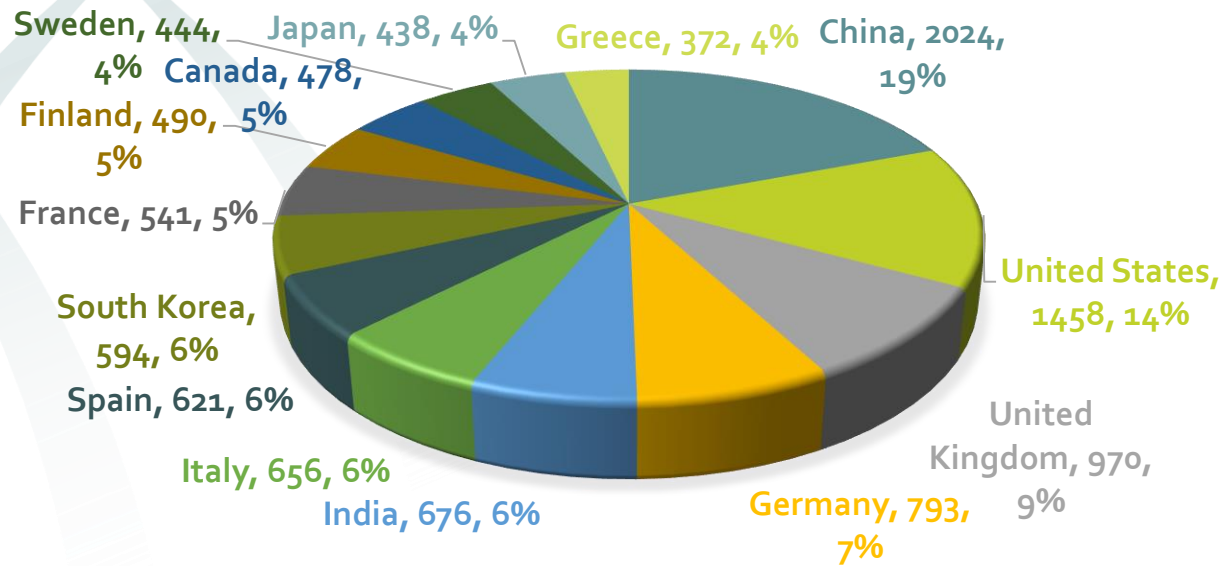
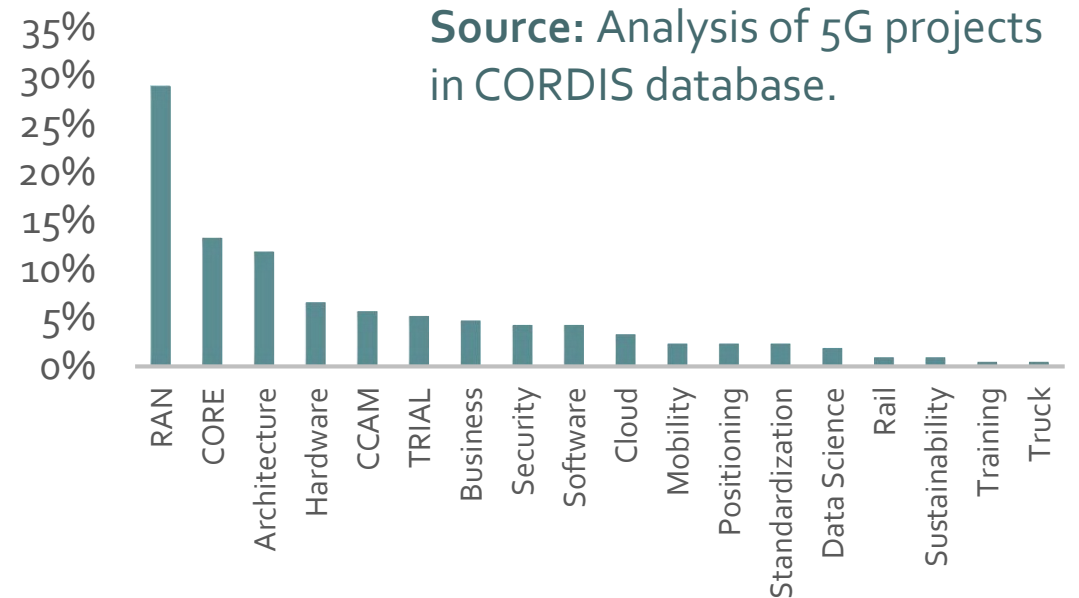


Figure 1. Research Papers contributions per country.



Source: Analysis of 5G projects in CORDIS database.

Figure 2. Distribution of H2020 funding.

Exponential rise of submitted papers after 2014
RAN & Core also lead the production of research papers world-wide
RAN & Core research has absorbed more H2020 funding

State of 5G - Patents

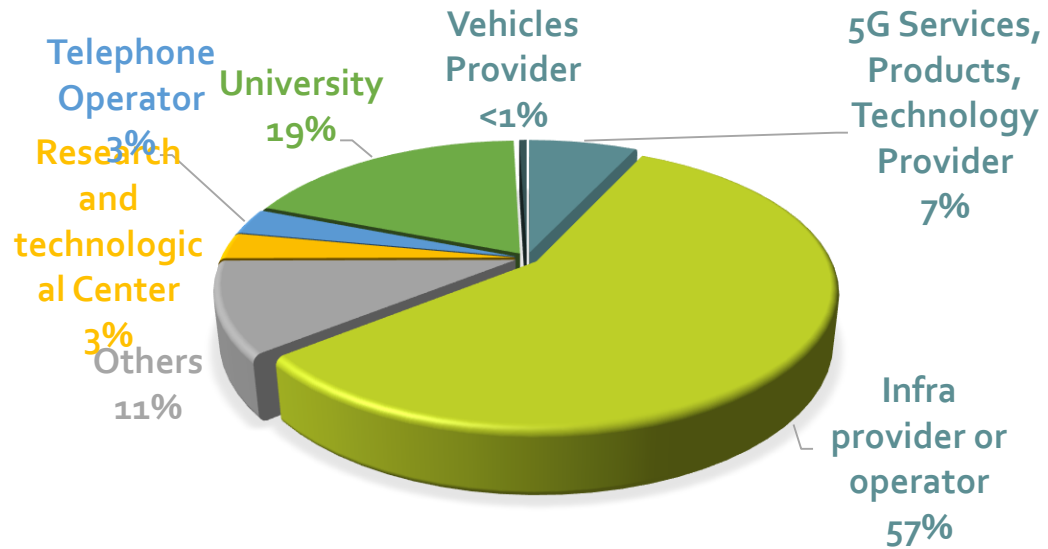


Figure 3. Contributors to patents

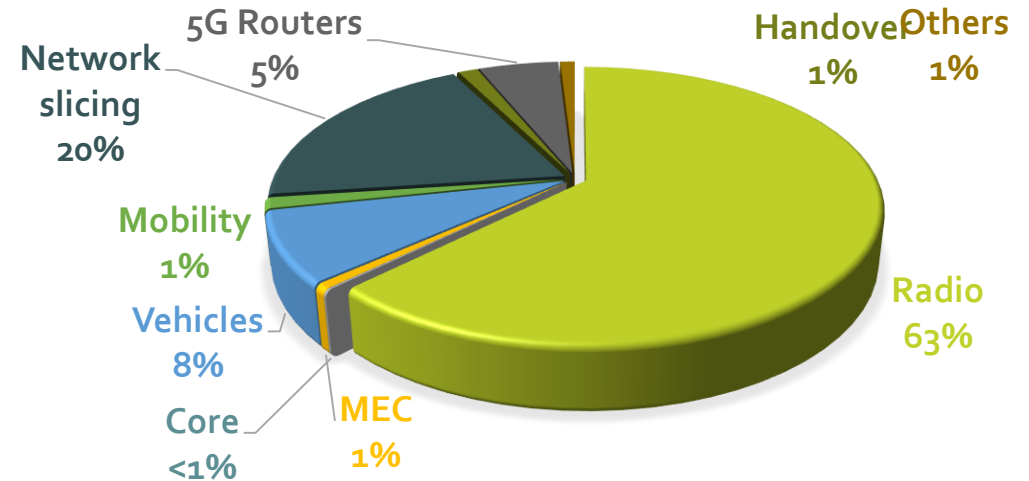


Figure 4. Patents per area

91% of patents were submitted after 2014
No signs of slowing down – potential indicator that we are far from market saturation
There is still potential for new product development

Barriers to business growth and adoption

We seem to be in an opportune place to place additional investment and create new products, but what are the barriers?

- **Lack of private investment:** from other sectors that can benefit from 5G/CCAM, lack of motivation for investment in R&D and new 5G/CCAM products
- **Disparities in EU Member States on technical and infrastructure levels:** (e.g. level of automation in ITS centres across the EU, local road infrastructure and GDP per capita can affect the rate of adoption of 5G/CCAM.)
- **Difficulty in harmonising and coordinating policies and standardisation between different companies and countries:** 5G and vehicle related, Privacy, Net neutrality, frequency harmonization etc. (Esp. across hard border)
- **Public lack of trust to automated vehicles:** Consumers find the idea of [relinquishing control as unnerving](#). A recent survey by [AAA](#) discovered that 88% of respondents felt unsafe to ride in an AV.
- **Unclear protection of Consumer Rights:** Many questions arise in terms of Consumer Protection, legislation should foster Consumer Rights and provide auto manufacturers, telcos etc. with clear liability borders. E.g how is roaming billed and taxed? What constitutes fair use in M2M roaming?

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Cybersecurity, Privacy and Trust concerns

- **Applicability of GDPR**, in cross-border exchange of data: **Adequacy Decisions**, Special Derogations, Binding Corporate Rules (Ch.5)
- **Applicability of ePrivacy Directive**: Vehicle can be considered as a “[terminal device](#)”: This legislation is being amended as a Regulation, will include protections for communication metadata such as location.
- The **5G EU Cybersecurity toolkit** suggests to increase the role of the National Regulators to include **Cybersecurity Audits and a level of control over the Supply Chain (trusted vs non-trusted vendors)**
- The [Guidelines on processing personal data in the context of connected vehicles and mobility related applications](#) list the main risks to privacy and security with respect to:
 - **Control and asymmetry of data protection**: are adequate controls are available to the driver?
 - **Quality of user consent**: “low-quality” consent based on a lack of information.
 - **Additional Processing & Extensive Data Collection**: No additional processing for further purposes is legitimate (e.g. AI and traffic management)
 - **Security of personal data**: Large attack surface and a lot of opportunities for an attacker to gain unauthorised access or otherwise compromise CCAM security.

Policy and Regulation concerns

- **How will Net Neutrality apply in the context of slicing?**
 - We need to ensure that critical services are not resource-starved when crossing a border.
- **Does M2M Roaming need its own regulation?**
 - Existing regulation abolishes roaming within EEA and provides a definition of “fair use” but BEREC suggests that M2M roaming needs its own regulation.
 - Clear protection of Consumer Rights: Transparency in Roaming Fees, Clear Taxation.
- **Spectrum Harmonisation on hard borders**
- The process for spectrum auctions should be optimised and a flexible mechanism should be in place to **enable leasing of additional frequencies.**
- **Exhaustion of numbering resources:** NRAs should analyse this and solve any occurring problems on national level, e.g. by introducing a new numbering ranges or increasing the mobile number resources.
- **Cooperation of Critical Infrastructures & Law Enforcement:** in case of a cyber-attack or during the investigation of a crime

Technical gaps provide insight on research priorities

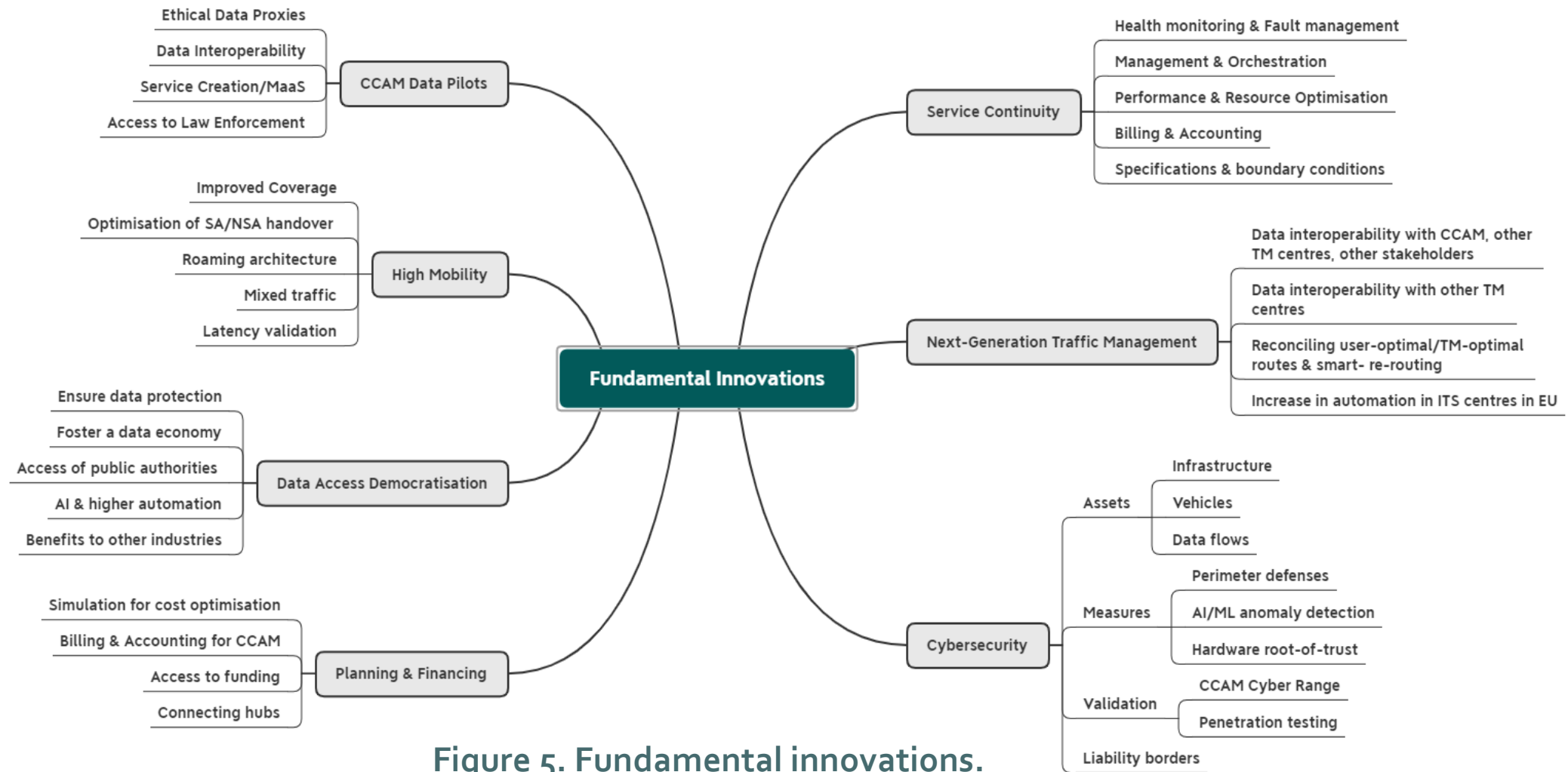


Figure 5. Fundamental innovations.

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5G-CCAM Enablers



TRAINED AND HIGHLY-SKILLED WORKFORCE

Highly skilled young professionals and **upgrading skills** in existing workforce (e.G. Traffic managers) . **Alleviate concerns for job security.**



IMPROVING EU COMPETITIVENESS

Investment in transport infrastructure **does not just benefit 5G/CCAM but regional competitiveness in general**



OPENLY DISCUSSING MACHINE ETHICS

A recent [survey from MIT](#) showed that **moral choices when driving are not universal**



CREATING A DATA ECONOMY

Ethical data proxies can be a step towards enabling a data economy without compromising our values

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5G-CCAM Enablers



ENSURING CONSUMER CHOICE

5G is integral to CCAM but the consumer **should not be locked-in** to a specific provider (e.g selling a vehicle). Data portability is also required.



STEP-WISE DEPLOYMENT

Incremental deployment of 5G infrastructure across transport corridors and CCAM "delta" (e.g Road Side Units).



LEGISLATING FOR THE FUTURE

EU legislation should be particularised and cover Consumer Rights, Roaming, Data Protection and many more.



NEXT GENERATION TRAFFIC MANAGEMENT

Next generation mobility enables **next-generation optimized traffic management**, although massive data collection should be GDPR-compliant

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If you are interested in receiving additional information from the project, or if you would like to provide feedback on our analysis, you may contact



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Thank you



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825496