fidal
field trials
beyond 5G

FIDAL PROJECT
KEY ACHIEVEMENTS

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6GSNS

Grant Agreement
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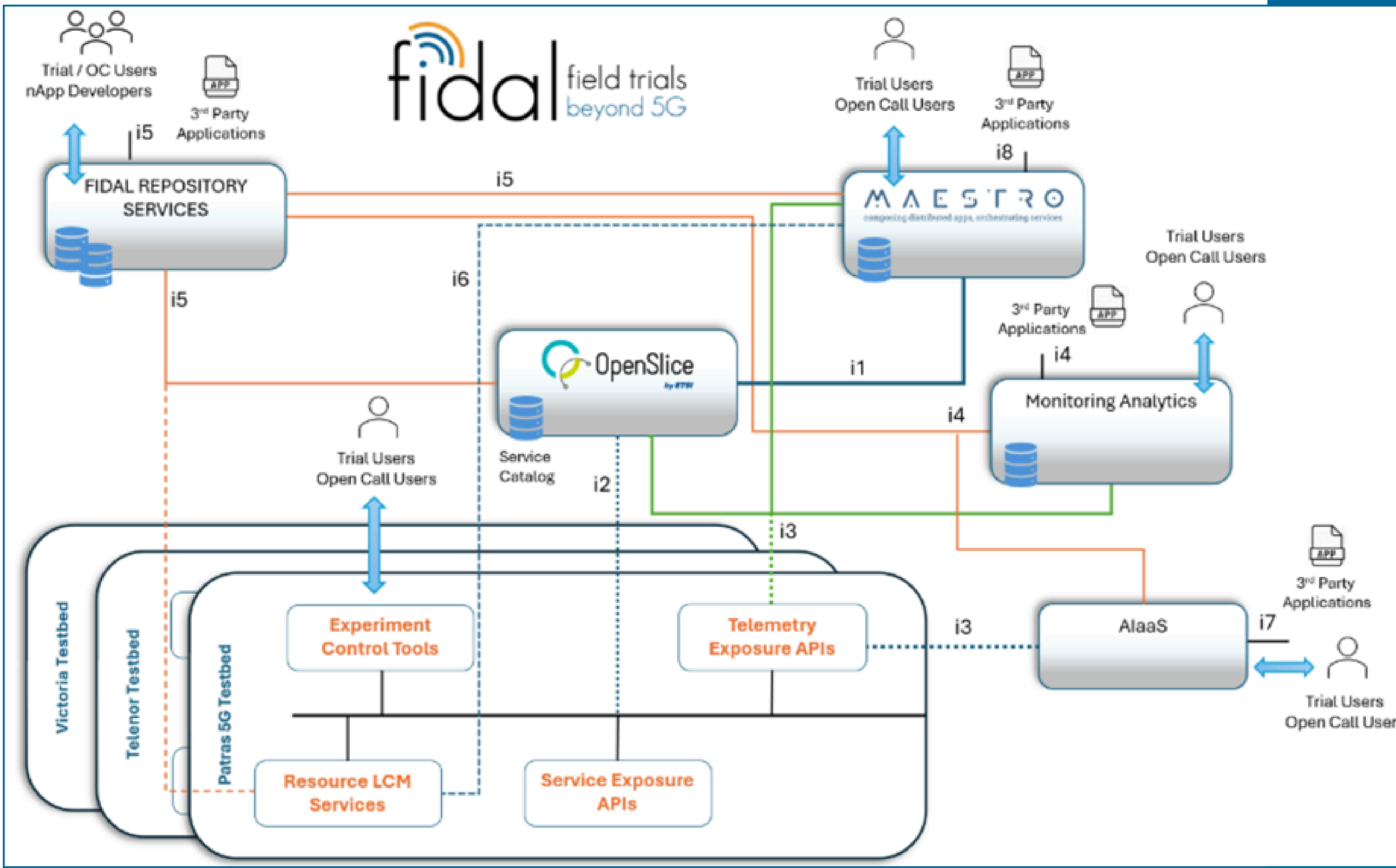
Table of Contents

1. THE EXPERIMENTATION FRAMEWORK



FIDAL Project successfully designed, deployed, and validated a **fully integrated zero-touch experimentation framework** for automated deployment, orchestration, and lifecycle management of network applications across distributed edge, core, transport and cloud domains.

The framework seamlessly integrates: Maestro (service orchestration), Open Slice (cross-domain slice and resource orchestration), Real-time Monitoring & Analytics, AI as a Service (AIaaS), the FIDAL Repository.

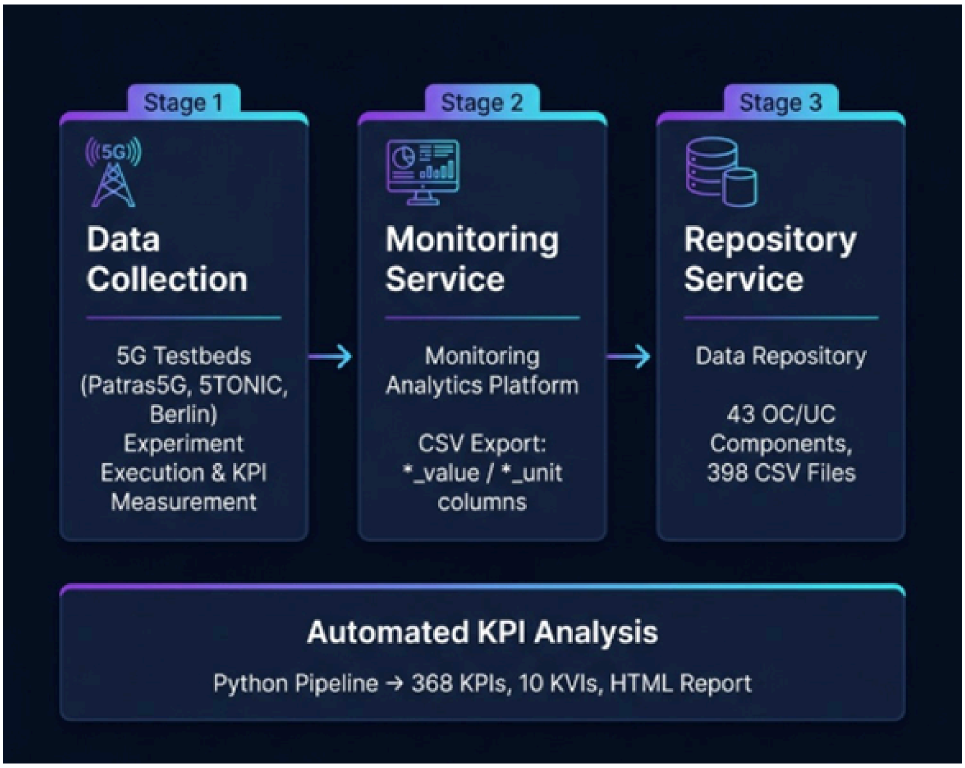
A major achievement is the realization of **end-to-end zero-touch provisioning**: high-level service requirements are automatically translated into compute, network, and storage allocations, with AI-driven closed-loop control dynamically adapting configurations based on telemetry and KPIs.

This enables **rapid, scalable experimentation with minimal manual intervention** across heterogeneous testbeds, large-scale trial sites, vertical use cases, and open calls.

Experimenters can onboard network applications via Maestro, trigger cross-domain slices through OpenSlice, monitor performance in real time, and leverage AIaaS for predictive analytics, anomaly detection, and adaptive optimization. The centralized Repository further supports reusability and reproducibility of network applications, AI models, datasets, and experiment artifacts.

2. END-TO-END DATA PIPELINE

An automated end-to-end data pipeline was developed for the collection, processing, and analysis of 5G trial KPIs. The pipeline operates in three stages:



Data Collection: During experiment execution across multiple 5G testbeds (Patras5G, 5TONIC, Berlin, Athens), KPI measurements are captured in real-time by the Monitoring Analytics platform. Each experiment produces time-series CSV files following a standardised *_value / *_unit column naming convention.

Monitoring Service: The Monitoring Analytics platform aggregates raw measurements from each trial, organises them per Operational Component (OC) and Use Case (UC), and exports structured CSV datasets along with experiment metadata (timestamps, testbed, partner, network application).

Repository Service & Automated Analysis: A fully automated Python-based analysis pipeline processes the entire data repository, performing KPI discovery, statistical computation (mean, median, P95, P99), classification into 6 KPI categories, and mapping to 10 high-level Key Value Indicators (KVIs). The pipeline generates an interactive HTML dashboard, summary CSVs, and a presentation-ready report, all within 60 seconds.

To date, the pipeline has analysed **43 OC/UC components across 308 trial** experiments, collecting **398 CSV data files and extracting 368 unique KPIs**. These KPIs are grouped into six categories: Core 5G, Latency, Throughput, Reliability, Compute, and Application. They are further mapped to ten KVIs: Service Availability, Latency, Throughput, Signal Quality, Media Quality, Compute, AI/ML, Surveillance, V2X, and Reliability. The KPI evaluation results show a 98.1% pass rate, with 155 passed evaluations and 3 partially passed.

3. TESTBEDS' CAPACITY

The FIDAL Project has carried out large-scale trials of innovative solutions in Media and PPDR, leveraging Beyond 5G capabilities and infrastructure provided through its testbeds. This includes seven core use cases and 28 open calls.

These activities have demonstrated the capacity of the FIDAL testbeds to support a wide range of use cases in parallel, while also enabling multiple iterative testing cycles. This iterative approach has created a strong feedback loop, where results from experimentation continuously informed refinements, adjustments, and further development of the solutions being tested. At the same time, this process has strengthened the experimentation framework itself, which was established early and designed to accommodate such a high volume and diversity of use cases, improving its robustness, flexibility, and readiness to support large-scale experimentation.

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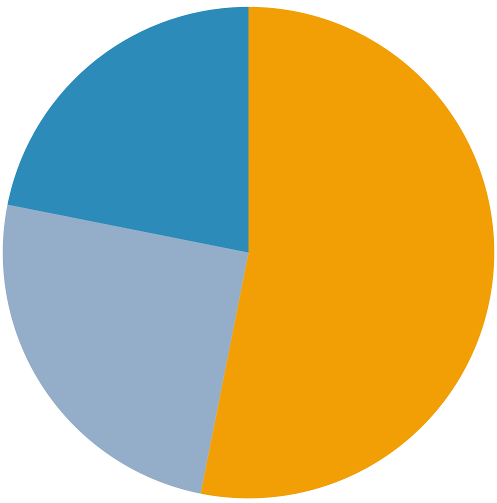


Use Cases and OCs Distribution per Testbed

- University of Patras/P-NET Testbed: **17 Use Cases**
- Victoria Malaga Testbed **8 Use Cases**
- Telenor Testbed **8 Use Cases**

3 OC conducted testing in external (OTHER) testbeds

4. FIDAL'S ECOSYSTEM: ENGAGEMENT WITH STAKEHOLDERS

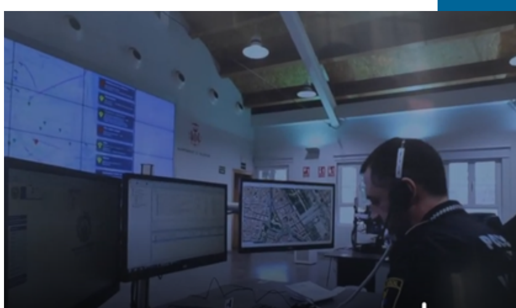
In FIDAL, the engagement with a diverse stakeholder ecosystem has been an important factor in ensuring that project developments remain technically relevant, and aligned with real-world user needs. This has been even further improved by extending the testing to third-party entities through the Open Call process. Across all testbeds, collaboration between academia, industry, SMEs, and end-user communities has enabled the project to combine technological innovation with practical deployment experience.

The involvement of stakeholders from vertical sectors provided valuable operational insight that informed the design, validation, and refinement of Beyond 5G services and applications.

The broad stakeholder engagement approach has therefore not only supported technical validation activities, but has also enhanced ecosystem building, accelerated innovation uptake, and strengthened the pathway from experimentation to future operational adoption.

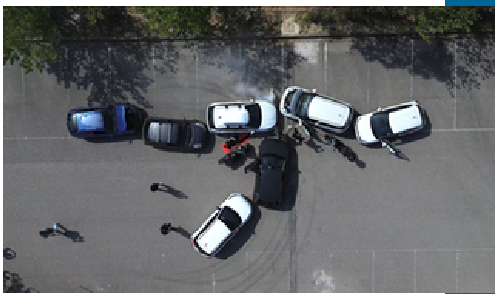
Victoria Malaga Testbed

FIDAL established strong collaboration with a diverse set of stakeholders involved in the Public Protection and Disaster Relief (PPDR) ecosystem, including Málaga Local Police as the primary end-user authority, Telefónica as the network operator, Airbus and OneSource as PPDR solution providers, and the University of Málaga as a research and validation partner. These collaborations enabled the successful execution and validation of advanced 5G-enabled public-safety services in realistic operational environments.



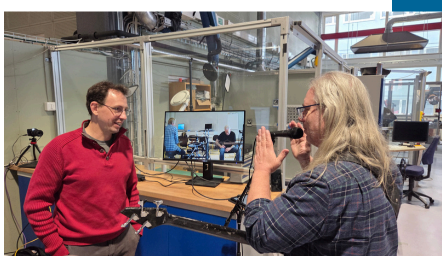
Patras Testbed

The University of Patras (UoP), in collaboration with PNET, operates the Greek testbed that has engaged a broad ecosystem of stakeholders across academia, industry, telecom operators, SMEs, vertical sectors, and the wider research community. Beyond the consortium, the testbed engaged a diverse group of external stakeholders. For instance, in the PPDR domain, the Hellenic Rescue Team (HRT) and KEMEA (Centre for Security Studies) contributed to validating mission-critical situational awareness and XR-assisted operations. In the Media domain, media professionals, content creators, sports producers, and event operators were engaged, validating advanced remote production workflows and high-quality multi-stream live content delivery.



Telenor Testbed

Stakeholder engagement through the Telenor testbed spans several domains and has created a strong foundation for collaboration and co-creation around future services, enablers, and platform capabilities, particularly for time-critical communications, network applications, and multi-site live telecommunications. Through FIDAL, Telenor has engaged with a broad range of external stakeholders, including experts in digital co-creation, local communities involved in citizen engagement initiatives, musicians and music educators, as well as sports and live-event organizers. The project has also strengthened collaboration with internal stakeholders across the Telenor Group, including the Group Sustainability team. In parallel, FIDAL has fostered continued cooperation with partners contributing to the deployment, readiness, and evolution of the Telenor experimental platform (iCORA), leveraging insights and experience gained from the FIDAL trials.



5. REAL-WORLD VALIDATION

Within the FIDAL project, testing of Beyond 5G solutions have moved from the Phase 2, focused on controlled laboratory environment, into Phase 3 testing in operational settings that reflected real user behavior, environmental constraints, and system complexity. By validating technologies under realistic conditions, FIDAL project has been able to generate credible evidence of performance, reliability, resilience, and scalability specifically in the verticals of PPDR and Media.

PPDR Vertical

FIDAL project demonstrated the feasibility and operational value of Beyond 5G solutions for the Public Protection and Disaster Relief sector through real-world validation activities and large-scale testing. The testbed environment provided a realistic setting for integrating, testing, and optimizing mission-critical applications before deployment, enabling the validation of advanced PPDR services that combined network applications, immersive situational awareness capabilities, Edge-enabled intelligence and AI-driven analytics, and advanced data processing for intelligent decision support and efficient management of mission-critical information, together with cross-domain orchestration. Field trials further confirmed the potential of these 5G-enabled solutions to support reliable real-time incident monitoring, responder coordination, high-resolution video transmission, accurate localization, and intelligent decision support in demanding emergency scenarios.

PPDR Example: UC3 & 5G-MOBITRUST

The UC3 PPDR trials leveraged advanced 5G capabilities, such as Quality of Service (and network slicing, to prioritise PPDR communications during large-scale events with thousands of attendees. . The trial aimed at showing how 5G enhances public safety communications by ensuring dedicated network resources for emergency services in critical situations.

These trials successfully demonstrated the use of network slicing on a 5G commercial network, ensuring the prioritisation of police communications in real-world scenarios. Additionally, the trials validated the use of OpenGateway QoD APIs to dynamically request on-demand traffic prioritisation for a specific 5G terminal within a slice. This capability alllows emergency services to adjust network resources based on operational needs, enhancing the reliability and efficiency of communications in high-demand situations.

Media Vertical

For the Media vertical, real-world validation activities demonstrated the capability of advanced connectivity solutions to support demanding production and distribution workflows in live operational environments. Field testing enabled the validation of use cases such as remote and distributed production, mobile content capture, and real-time contribution over 5G networks. The media-specific verified the conditions under which the video and audio transmission can be maintained with low latency and reliable synchronization, even in dynamic and high-density settings.

Media Example: UC4

FIDAL's Use Case 4 demonstrated live upload of professional and user-generated sports content using advanced 5G connectivity. The trials focused on enabling ultra-high-definition uplink streaming in crowded stadiums while supporting alternative viewing angles without network congestion.

The solution was validated through live tests at Atromitos FC Stadium in Athens and controlled trials at University of Patras/PNET 5G testbed. These test aimed to reproduce the scenario, establish reference KPIs, troubleshoot technical issues, and verify the resolution of freezing and blocking problems.

Results showed broadcasters can successfully enrich live feeds with user-generated content using standard smartphones without additional battery consumption. However, broadcast-quality footage requires contributors to be closer to the field or equipped with advanced zoom capabilities.

Reliable video quality in congested venues depended heavily on 5G network slicing. Prioritized slices maintained stable high-quality streams during saturation, while default slices failed when uplink capacity was exceeded. The trials also highlighted the need for adaptive bitrate control and remote, centralized production workflows, as on-site monitoring was affected by local network playback artifacts.

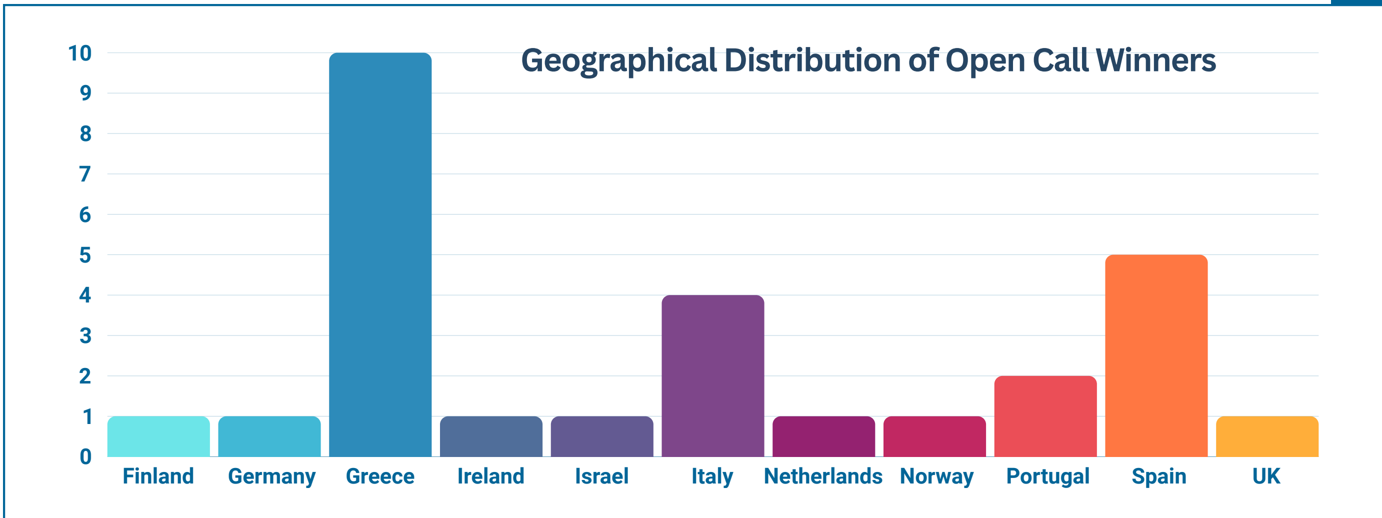
6. CASCADING OPPORTUNITIES: THE FIDAL OPEN CALLS

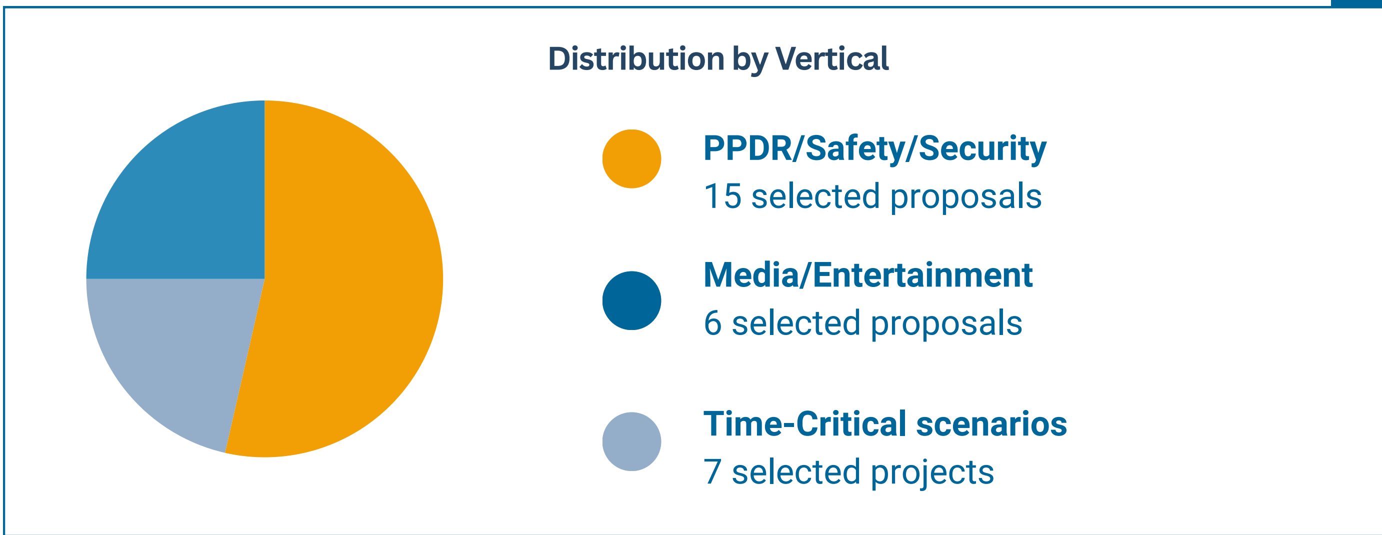
The FIDAL Open Calls were established to operationalize the project's objective of opening its advanced experimentation environment to external innovators and to complement the project with additional Beyond-5G trial activities. The OCs attracted significant interest from a diverse community of innovators, reflecting both the maturity of the project's experimentation framework and the relevance of its testbeds to real-world Beyond-5G trials.

FIDAL ran two successful Open Calls:

- OC1 (September – December 2023)
- OC2 (September – December 2024)

With 19 winners in the first round and 9 in the second, a total of 28 proposals were provided the opportunity to leverage FIDAL's Beyond5G capabilities to test their innovative solutions.





7. THE KEY VALUE INDICATORS PROCESS

The FIDAL's KVI methodology development was grounded in established frameworks such as the UN SDGs, the 6G-IA White Paper on KVIs, prior project results, and guidelines like the Welsh Well-being of Future Generations Act, the UK Social Value Act, and the National TOMs Framework. The methodology follows an iterative, multi-step process based in co-design with use case owners and broader stakeholder input.

KVIs were co-developed and refined alongside evolving use cases through planning sessions and cross-team workshops. FIDAL recognised that defining KVIs in isolation risks producing disconnected metrics, as values, impacts, stakeholders, and measurement feasibility are context-specific. Collaborative development ensured that KVIs remained grounded in real goals while maintaining enough commonality for project-wide comparison and learning.

The resulting framework balances rigour with adaptability: some KVIs use consistent assessment procedures across all use cases, while other indicators are tailored to specific trial contexts. As values have no hard finish lines, the project framed social values as evolving goals, not fixed threshold, acknowledging the lack of clear baselines for meaningful impact.

Each KVI was built through a sequence of steps: identifying the value at stake and the beneficiaries, determining the scale of intended impact, assessing the risks if the innovation fell short, before arriving at what to measure.

What has worked well

Diversity of KVI types: The framework used a wide range of indicator types rather than a single approach. These include quantitative and qualitative metrics, surveys, demographic statistics, enabler verification, and evaluations of technical or business plans. All share the goal of looking beyond user experience to measure proxies for real-world societal impact, asking not only whether the technology worked, but what difference it makes and for whom.

Flexibility built in by design. The framework combined two levels of KVI: those assessed consistently across all use cases, and those that shared a common high-level definition but were tailored to each use case'. The cross-use-case KVIs were particularly valuable because the variation in results revealed how the same societal value plays out differently depending on the domain, stakeholders, and deployment context.

Pairing of social and technical indicators: Some KVIs were structured as paired socio-technical metrics, combining objective technical data with subjective stakeholder feedback. For example, the Trustworthy KVI linked latency measurements with user survey responses on perceived dependability. This pairing confirmed not only whether the technology performed as intended, but also whether that performance translated into the social outcomes that motivated the design decisions in the first place.

Traceable mapping from value to indicator: Making the justification for each measurement decision explicit and documenting it alongside the results strengthened the credibility of findings and helped teams justify their choices.

KVIs informing project decisions: When assessed mid-project, KVI results fed directly into design decisions and course corrections. When assessed later, they served as guides to generate insights for next steps

8. CONTRIBUTION TO STANDARDS

Standardization activities within the project have evolved significantly from initial contribution phases into a more consolidated, strategic, and impact-driven engagement with major Standard Development Organizations.

Project partners are now contributing not only individual technical inputs derived from project use cases, but are also actively influencing discussions across multiple standardization ecosystems. These include both vertical-specific bodies — such as media and Public Protection and Disaster Relief (PPDR) organizations — and cross-domain frameworks including 3GPP and ETSI.

In parallel, the project has strengthened its contribution to open-source-driven standardization activities, reinforcing the connection between experimental validation, interoperability testing, and pre-standardization efforts. This approach has enhanced the project's ability to translate practical implementation experience into tangible inputs for future standards development and industry adoption.

9. OPEN SOURCE CONTRIBUTIONS

FIDAL delivers a strong open-source contribution by releasing and validating key project outcomes through established ETSI Software Development Groups (SDOs) and public repositories. In particular, FIDAL contributed to ETSI SDG OSL / OpenSlice for service and experiment orchestration, especially around cloud native orchestration and AI capabilities and OCF and TF integrations, ETSI SDG OCF / OpenCAPIF for CAPIF-based exposure and API management , and ETSI SDG TFS / TeraFlowSDN for programmable transport and SDN control.

Beyond platform components, FIDAL made available selected services and enablers as open source, including AI-as-a-Service and related experimentation functions, together with an open repository of FIDAL Network Applications.

The project also promoted reproducibility and reuse by publishing open models, curated datasets, and trial artefacts through the FIDAL repository, SNS repositories, GitHub, Zenodo, and other appropriate open-access channels.

Fidal Partners

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