6G-IA WORKSHOP REPORT

Connected Industry: Smart Manufacturing Meets Smart Networks and Services

Key findings and input to the SNS JU R&I orientations for WP2027

Virtual workshop, 12 May 2026 · Organised by 6G-IA – CO-OP CSA

Executive summary

The 6G-IA workshop on 12 May 2026 gathered ICT vendors, telco operators, OT vertical stakeholders, and research organisations to inform the final SNS JU call under WP2027 (€228 M envelope). In particular, the planned ~€15 M trial-and-pilot project on Smart Industry and the horizontal ISAC project. **Five messages dominated the record.** First, **6G must be an evolution of 5G, not a clean break**: investment protection, backward compatibility and a credible coexistence path (MRSS-style spectrum sharing) are pre-conditions for industrial adoption. Second, **uplink capacity, UL/DL symmetry and uplink scheduling are the single most-cited technical gap**, driven by sensing, vision, AI inference offload and tele-operation. Third, **determinism, URLLC reliability, multicast and TSN/IEC-IEEE 60802 integration** remain only partially implemented relative to what 3GPP has standardised. Fourth, **the industrial 5G ecosystem is still stuck in a chicken-and-egg loop** i.e., scarce industrial devices, expensive modules, and OT decision-makers losing patience. Fifth, **deployment-grade certification, lifecycle stability and ease-of-use are first-class requirements** and not nice added features. Cutting across all five: participants are asking for opportunities for funding deployment, ecosystem enablement and end-application adoption and not more proofs of concept. They also asked to pair the 6G research agenda with a European sovereignty layer (chipsets, modules, sovereign cloud, European AI). One framing recurred in the review. Most of these are adoption challenges, not 6G problems. They already exist with 5G today. The blocker is rarely the technology itself. It is ecosystem readiness, device availability, certification and a clear business case.

1. Workshop context and participants

The workshop was part of a series feeding 6G-IA's contribution to SNS R&I WP2027 orientations. The format was closed-door, focused on senior representatives. ICT vendors: Ericsson (A. Osseiran, J. Sachs), Nokia (A. Länsisalmi, D. Bourse. Telco operators: Orange (V. Tornero), Telenor (H. Lønsethagen), Deutsche Telekom (D. Seul). OT verticals: Deutsche Bahn (F. Schroell), Siemens (J. Riedl, M. Bahr, D. Mai), ABB (L. Thrybom), Airbus Defence and Space (A. Boubendir),), Mitsubishi Electric (O. Tamori). Research: CTTC (N. Bartzoudis), ifak (L. Underberg). Public side: SNS JU office (P. Fournogerakis) and 6G-IA executive director (A. Kaloxylos). Several participants also wear 5G-ACIA hats, and the workshop confirmed 5G-ACIA as the the central global forum for shaping 5G and beyond in the industrial domain, and a natural channel for industrial requirements into 3GPP.

2. Top use cases and trends

The verticals presented a consistent priority pool, anchored in private and campus networks. Five clusters converge across rail, factory and process automation, mining and ports, aviation/space and energy:

- **Wireless control of mobile and rotating assets:** PLC-to-device and PLC-to-machine-cell control, AGVs/AMRs, cranes, mining equipment, interoperable with IEC/IEEE 60802 industrial Ethernet (Siemens, ABB).
- **AI- and vision-driven sensing and inspection:** uplink-heavy data acquisition, drone inspection (gas leaks), wide-area sensor data, AI/vision offload to shared edge compute (Orange, ABB, CTTC).
- **Tele-operation in hazardous or remote environments:** remote control with kinesthetic and tactile feedback channels, 8K stereoscopic uplink, <5 ms RTT, edge render (CTTC, DB).
- **Worker safety via JCAS / ISAC:** sensing-enabled safety at level crossings, worksites and depots, with false-alarm-controlled operation (DB, Nokia).
- **Predictive maintenance and digital twins:** power grids, in-vehicle, manufacturing, structural-health monitoring, anomaly detection (CTTC, Telenor, DB).

Rail (Deutsche Bahn) flagged four specific 6G entry points: MC radio convergence (UC2) migrating from BOS / 450 MHz to FRMCS / 5G MC services; high-precision yard operations (UC5) combining GNSS and 5G/6G; worker protection and sensing (UC11); and an explicit standardisation feedback loop into SNS JU (UC8) backed by lifecycle compatibility (UC6). Airbus added two angles: industrial-process connectivity across multi-country aviation and space manufacturing sites, and 5G/6G and 5G/6G-NTN as connectivity offerings for aircraft and satellites. Telenor framed the operator-side trajectory: from connectivity to integrated service platforms bundling connectivity, edge compute, security and deterministic behaviour.

3. Requirements, gaps and missing 3GPP features

The requirements raised at the workshop are consolidated in Table 1. Entries are grouped thematically with originating contributors.

Domain	Requirement / gap	Raised by
Uplink & UL/DL	Symmetric and asymmetric UL, DL traffic patterns; >100 Mbps UL per device for sensing and vision; UL-aware scheduling, not just more UL spectrum.	Siemens, ABB, DB, CTTC, Nokia
Determinism, TSN, URLLC	Sub-µs E2E clock sync (IEC/IEEE 60802); bounded jitter (≤10 µs); 1 ms deterministic latency; URLLC features standardised but largely optional and weakly implemented.	Siemens, ABB, CTTC
Multicast / pub-sub	Native multicast / publish-subscribe transport for industrial protocols; structural pain point today.	ABB
Industrial protocol integration	Seamless support of IEC/IEEE 60802 and industrial Ethernet — wireless integrates into the industrial context, not the reverse.	Siemens, ABB
Sensing / JCAS / ISAC	Native cm-level sensing; OT-facing exposure APIs; validated low false-alarm behaviour; sensing maturity in metallic / multipath environments.	DB, CTTC, Nokia, Ericsson
Positioning	Centimetre-level positioning robust in dense industrial environments; GNSS + cellular + complementary technologies.	DB, Telenor
Private networks & spectrum	Operation with and without PLMN; network-size and functionality scaling; harmonised dedicated spectrum (e.g. 3.7–3.8 GHz, local 26 GHz).	Nokia, Siemens, ABB, DB, Telenor
5G→6G coexistence & lifecycle	MRSS-style multi-radio spectrum sharing; long parallel operation; no forced HW swaps; certification-friendly evolution for 15–25 year assets.	DB, Siemens, Nokia, ABB
AI / agentic operation	AI-native RAN; agentic xApps for OT-load adaptation; edge/cloud split; explainability and auditability for safety-related workflows.	Nokia, Ericsson, CTTC, DB, Siemens
Certification & test	Industrial-grade certification profiles for private-5G features, integrated with established carrier certification (e.g. GCF); compliance + performance testing; “no regression” governance.	DB, ifak, Siemens
Ease of use & operations	Intent-based interfaces; automated operation without dedicated radio expertise on the OT side; modularity and adaptability after deployment.	Siemens, ABB, DB
Resilience	Resilience as a 6G design principle from day 1 — covering human error, system failure, malicious action, third-party failure and natural events.	Deutsche Telekom

Table 1. Consolidated requirements and gaps raised at the workshop.

Three observations on Table 1. First, several rows describe *implementation gaps, not specification gaps*: URLLC, time synchronisation, multicast and UL/DL flexibility are largely covered by 3GPP, but optional features, weak chipset support and limited end-device availability block deployment. Second, the verticals are unanimous on *the dominance of uplink*. Third, *certification and operational simplicity* were treated as research-relevant topics in their own right — they shape what the industrial customer can specify, purchase and integrate.

4. Cross-cutting ecosystem messages

4.1 The 5G industrial ecosystem is unfinished

Deutsche Bahn put it bluntly: 5G already meets ~99% of operational needs on paper, yet industrial adoption is held back by a chicken-and-egg loop — scarce industrial endpoints with seamless private-5G campus compatibility, expensive and scarce 5G modules versus mature Wi-Fi, late RedCap arrival, and procurement teams that cannot specify what suppliers do not yet build. Mitsubishi Electric reinforced the point: parts of the OT world are losing interest in 5G and drifting back to alternatives, and the ROI story is missing.

4.2 European sovereignty as an industrial precondition

Ericsson opened with the recent joint statement of European tech creators (Airbus, ASML, Ericsson, Mistral AI, Nokia, SAP, Siemens) on digital competitiveness. Deutsche Bahn made the underlying dependency concrete: Europe has lost its mobile-chipset footprint; industrial and rail use cases now depend on non-EU silicon roadmaps. Telenor's sovereign-cloud and AI-factory initiatives, and Siemens' position paper call for private-use spectrum, fit the same theme. Several speakers asked SNS JU to consider chipset / IP / sovereign-cloud aspects alongside 6G research.

4.3 ICT and OT cycles do not match

5G campus deployments are still picking up while ICT focus has already shifted to 6G; FRMCS on 5G is not expected to be operationally ready before ~2035, and there is currently no plan to migrate FRMCS to 6G. The implication for WP2027: the 6G story for industry must explicitly support continued 5G focus and a credible migration path.

4.4 Certification and “deployment-grade” outputs

Certification was the longest single discussion at the workshop. Lisa Underberg (ifak) pointed out that the absence of an industrial certification and performance-testing regime has helped lock 5G into its current state. Siemens distinguished compliance from performance testing; Deutsche Bahn recounted how a firmware upgrade once stopped operations in a depot. The shared ask for WP2027 is concrete: deployment-grade outputs (certification profiles, test suites, adoption toolkits), “no regression” governance, and lifecycle commitments compatible with 15–25 year asset lives.

4.5 From technical capability to business value

Verizon Business flagged a gap in business value. The report is strong on technical capability. It is thinner in business value. Industry does not buy uplink or determinism for its own sake. It invests in improving productivity, safety, resilience, and sustainability. WP2027 should make that link explicit. Each funded trial should state the business outcome it serves and not only the feature it proves.

5. Demos, trials and R&I orientations for WP2027

Trial / demo direction	Scope	Source
Industrial campus testbed at scale	>100 UEs in real control loops in challenging radio conditions; credible for end-customers, not 2-device demos.	ABB, CTTC
Mission Critical convergence pilots (UC2)	Yard radio / remote control migration with explicit security and governance scope.	DB
5G-Advanced campus with 6G-readiness (UC5)	Depot and yard pilots: positioning, AGVs, wayside sensorics, TSN bridging.	DB, Siemens
Passenger 5G+ corridor (joint with MNOs)	MTS RF-transparent windows, in-train Wi-Fi / moving-cell, 5G-Advanced uplink.	DB, Telenor
ISAC in industrial environments	Reference ISAC implementation framework with function-exposure APIs, openness to third parties, EU-based AI service support model, ≥3 third-party UC validations.	Orange, Nokia, CTTC, 6G-IA
Worker protection & JCAS (UC11)	Worksites and level crossings, false-alarm-controlled, real metallic/multipath validation.	Orange, DB, Nokia
Lifecycle & certification work-stream (UC6/UC8)	Rail-ready blueprints, no-regression governance, feedback loop into SNS JU calls.	DB, ifak, Siemens

Trial / demo direction	Scope	Source
Agentic-AI RAN with FPGA-accelerated O-RAN	xApps for autonomous radio orchestration under bursty OT loads; sub-1W inference.	CTTC
Federated ML across industrial sites	On-device training for multi-plant predictive maintenance; data sovereignty by design.	CTTC, DB

Table 2. Trial and demo directions consolidated from the workshop.

How SNS JU should act — workshop consensus

- Require deployment-grade outputs in WP2027 trials and pilots: certification profiles, test suites, adoption toolkits, "no regression" governance.
- Fund ecosystem enablement, not only prototypes: vendor and device readiness, interoperability labs, lifecycle commitments for industrial modules (RedCap, Cat-1bis, 5G-Advanced and beyond).
- Fund end-application adoption with real device demand behind it, rather than additional isolated PoCs; ensure active vertical engagement in co-design, validation and demonstration.
- Treat the 5G→6G migration story (MRSS-style coexistence, certification-friendly evolution) as a structural deliverable of WP2027, not a side-topic.
- Leverage and reuse existing SNS-JU Stream C and Stream D assets and national infrastructures, with clear justification of reuse to avoid duplication.
- Tie funded work to business outcomes: ask projects to show how advanced connectivity improves productivity, safety, resilience or sustainability, and to build repeatable business models that other industrial sites can adopt.

6. Role of AI in 6G for industry

- **Operations-safe and auditable.** DB, ABB and Siemens emphasised that AI in safety-related workflows must be auditable, bounded and explainable. Anomaly detection, predictive maintenance and planning optimisation are clear early wins; closed-loop safety control is not.
- **Sovereign deployment options.** DB's two-track approach — a licensed foundation model on its own EU infrastructure, plus fine-tuned open-source models running locally for use-case-specific tasks — is a useful template. Europe-side bottlenecks (GPU availability, energy cost) were raised explicitly.
- **Joint AI–connectivity development is under-resourced.** Nokia noted that AI for automation systems and AI-native 6G are advancing too independently. Bringing them together is an opportunity WP2027 can act on.

7. Conclusions and next steps

The workshop produced a coherent and largely consensual set of inputs for WP2027. On use cases and requirements, there is little dispute among ICT vendors, operators, OT verticals and research centres; the disagreement, where it exists, is on pace and framing. The ecosystem messages were sharper than the technical ones, and that is the part most actionable for the SNS JU work programme. One point from the review sharpens the priority. The open question is no longer whether 6G works, but whether industry can deploy, operate, and scale it in real-world settings. Europe has already funded many pilots and proofs of concept. The next step is large-scale deployment, ecosystem readiness, certification frameworks, and business models that are repeated across industries.

What 6G-IA should carry into WP2027

(i) A Smart Industry trial-and-pilot project anchored in private/campus deployments with deployment-grade certification and lifecycle deliverables; (ii) an ISAC project with explicit industrial validation (≥3 third-party UCs); (iii) explicit treatment of the 5G→6G migration story (MRSS, no forced HW swaps); (iv) ecosystem-enablement instruments (device readiness, interop labs, no-regression governance) funded alongside research; (v) European sovereignty (chipsets, modules, sovereign cloud, European AI) treated as a pre-condition for industrial uptake, with coordination across SNS JU, Rail JU, KDT/Chips JU and national 6G programmes.

Agreed next steps

- 6G-IA to circulate slides in PDF and a draft of this report for participant review.
- Participants who did not present (Airbus, Mitsubishi Electric, Deutsche Telekom, Orange, ifak) invited to submit additional written input.
- SNS JU formal consultation on the draft WP2027 expected to open on 22 May 2026 and close around mid-June 2026; 6G-IA members are encouraged to respond.
- Workshop inputs to be reflected in the Smart Industry trial-and-pilot project (~€15 M, TRL 6–8) and the horizontal ISAC project text.
- Coordination with Europe's Rail JU, KDT/Chips JU, and national 6G programmes should be pursued where points raised at the workshop fall outside the SNS JU scope.