



EXECUTIVE CONTROL AI

[ECAI V5.0 PRO]

Autonomous Industrial Enterprise AI
(Edge-to-Cloud Cyber-Physical Operating System)

Official Strategic & Technical Whitepaper

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[Editable placeholder: Hexagonal ECAi circuit logo]

CONFIDENTIAL ENTERPRISE WHITEPAPER | v5.0 PRO | OCTOBER 2026

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SECTION 1: EXECUTIVE SUMMARY, STRATEGIC MISSION & ARCHITECTURE DOCTRINE

1.1. Product Identity and Technical Definition

- **Full Solution Name:** Executive Control AI (ECAi v5.0 Pro).
- **System Classification:** Autonomous Industrial Enterprise AI / Cyber-Physical Edge OS.
- **Architecture Model:** Edge-to-Cloud hybrid architecture prioritizing local operational sovereignty (Edge-First Industrial Architecture).
- **Core Operating Doctrine:** Protocol-agnostic processing, elimination of rigid rules and static filters (*anti-hardcoding*), integrating advanced machine reasoning with real-time translation of physical telemetry into financial loss indicators.

1.2. Industrial Problem Statement (Pain Points in Automotive & Discrete Manufacturing)

Automotive production and high-precision, discrete manufacturing lines face critical operational bottlenecks:

1. **Delayed Visibility and Data Silos:** Legacy SCADA and MES environments capture millions of machine error codes, but their aggregate financial impact remains unknown until accounting cycles close.
2. **Costly Scrap Rates:** Undetected micro-deviations in mechanical parameters (press hydraulic profiles, mold thermal hysteresis, welding gun axis drift) drive scrap levels to 5–10%.
3. **Cloud Dependency and Network Latency Risks:** Factories cannot expose safety-critical automation loops to external internet latency, jitter, or cloud service outages, nor risk leaking proprietary operational telemetry.

1.3. Strategic Objectives, Edge Doctrine & Verified KPIs

ECAi converts reactive maintenance logs into deterministic, closed-loop industrial process control:

- **Scrap Reduction:** Drop in defect and scrap rates from 8.4% to below 2.0%.
- **OEE Elevation & Stabilization:** Continuous machine availability and performance maintained at 92.5%.
- **Rapid Payback Period:** Capital recovery achieved in less than 0.4 months (ROI < 0.4 mo).
- **100% Air-Gapped Edge Autonomy:**
 - The industrial edge appliance (Jetson Orin Nano / AGX Industrial Black Box) executes continuous telemetry ingestion, anomaly triage, and remediation directives locally, operating without an active cloud or internet connection.
 - Cloud GPU infrastructure is engaged strictly on an asynchronous, selective basis for multi-parameter deep causal reasoning during critical incidents or for periodic Digital Twin recalibration.

1 ms

Fastest Edge Processing

92.5%

OEE Target

< 0.4 mo

ROI

1.4. Universal Ingestion & Industrial Protocols

The ECAi edge appliance functions as a multi-protocol hardware-to-software ingestion bridge:

- **Direct Fieldbus & PLC Connectivity:** Native deterministic support for Profinet, Modbus TCP, OPC UA, and EtherNet/IP.
- **Higher-Level IT/OT Integration:** Parsing log dumps from MES, SCADA, and ERP environments alongside dedicated REST API and Webhook endpoints.
- **Input Formats:** Real-time continuous telemetry streams, physical machine state snapshots, raw text log files, and high-resolution power profiles (MWh).

1.5. Commercial Model & Deployment Terms

- **Hardware & Edge Setup (Black Box / Digital Twin):**
 - **€50,000 one-time setup fee per line:** includes IP66 industrial edge appliance delivery, fieldbus physical integration, machine telemetry mapping, and initial Digital Twin calibration.
- **AI Compute & SLA Maintenance (24/7/365):**
 - **€15,000 / month per line:** covers software licensing, edge algorithm execution, 24/7 SLA engineering support, continuous Digital Twin adaptation, and on-demand cloud GPU cluster allocations.
- **Multi-Line Enterprise Tiers:** Multi-line factory packages (up to 10 lines per plant) are structured under scalable volume discounts.

1.6. Legal Notice: Intellectual Property (IP) Protection

The system architecture, algorithmic methods, and analytical frameworks represent the exclusive Intellectual Property (IP) of the Founder, Remigiusz Gaszewski, protected by international copyright laws and trade secret regulations:

1. **Copyright on Source Code and Methodology:** The 3-Path Remediation Matrix (Path I: Corrective, Path II: Preventive, Path III: Adaptive AI) and the physical-to-financial loss translation algorithms are proprietary assets.
2. **Institutional Recognition:** The core IP is formally registered within the European Funds for Eastern Poland Program (Start in... Platform, Application No. FEPW.01.01-IP.01-1528/26), forming the verified basis for patent and utility model filings.

1.7. Digital Twin & Tribal Knowledge Codification

A critical operational vulnerability in discrete manufacturing is the loss of senior engineering experience (Tribal Knowledge) due to workforce turnover.

- **Process Digital Twin:** ECAi maintains a multi-dimensional, physics-informed digital representation of machine behavior, capturing cross-variable interactions (e.g., simultaneous welding current spikes to 15,890 A and pneumatic pressure drops to 62.1 PSI on ROB-WELD-04).
- **Codification of Operator Instincts:** The system translates manual corrections made by veteran operators into deterministic, repeatable rules within the 3-Path Remediation framework, permanently securing intellectual capital inside the software.
- **Predictive Component Protection:** The Digital Twin detects mechanical degradation prior to failure (e.g., predictive bearing seizure alerts on KUKA KR210_A3 and ROB-04 securing €8,700 to €15,000 in capital protection per event).

1.8. Safety Doctrine: Human-in-the-Loop (HITL) & Shadow Mode

Deploying autonomous AI on Tier 1 Automotive production floors requires eliminating catastrophic false alarms (zero hallucination, zero false trips):

- **Human-in-the-Loop (HITL):**
 - ECAi operates as a precision advisory engine: anomalies are triaged, financial exposures are calculated, and exact setpoint corrections are presented.
 - Execution authority for setpoint modifications or physical maintenance overrides remains with plant engineers.
 - Operator feedback loops continuously refine local model weights, closing the adaptive learning cycle.
- **Shadow Mode Deployment (Read-Only Sandbox):**
 - As verified in report ECAI-SM-20261016-0017, initial installations operate in non-intrusive Shadow Mode.
 - Telemetry is ingested in read-only mode with zero control intervention (PLC control: DISABLED, Production interference: NONE).
 - Closed-loop actuation is enabled only after field validation by plant management.

1.9. Field Evidence: Operational Telemetry Results

System performance and economic returns were validated using real factory telemetry across robotic welding, CNC machining, and stamping cells:

Metric / Operational Parameter	Verified Benchmark Value	Direct Business Impact
Edge Processing Speed (Fastest)	1 ms (Average: 4 ms)	Microsecond-level anomaly detection preventing line

		damage.
Capital Protected	€178,438 (across 10 assets)	Prevented downtime (€108k) and averted asset damage (€53k).
Identified Waste Exposure (Scrap)	€9,145	Direct identification and mitigation of defective part runs.
Environmental Decarbonization	34,640 kg CO ₂ (61.9 MWh saved)	Documented compliance with EU corporate sustainability mandates.
Classification Efficiency	17 critical events isolated from 108 anomalies	Complete elimination of alarm fatigue for maintenance teams.

1–4 ms

Edge Latency

€178,438

Capital Protected

€9,145

Waste Exposure

34,640 kg

CO₂ Avoided

1.10. Enterprise Security, Privacy & Regulatory Compliance

ECAi adheres to rigorous data sovereignty, cybersecurity, and regulatory standards:

- **A. Data Protection Doctrine:**
 - *AES-256 In-Flight Encryption:* All industrial telemetry streams and system payloads are encrypted in transit via AES-256.
 - **Aethir Edge Decentralized Containers:** Cloud reasoning runs in isolated GPU instances guaranteeing hardware-level privacy.
 - **Zero Data Retention:** Telemetry payloads are permanently purged from volatile RAM once financial loss reports are compiled; zero persistent storage of sensitive line data.
 - **Dedicated GPU Allocations:** Multi-tenancy isolation ensures zero shared memory with third-party workloads.
 - **No Public Model Training:** Proprietary production logs and factory know-how are never used to train public machine learning models.
- **B. Regulatory Compliance Matrix:**
 - **ISO 27001:** Certified Information Security Management systems and access controls.
 - **SOC 2 Type II:** Operational security, process integrity, and system availability standards.

- **EU NIS 2 Directive:** Meets cybersecurity resilience requirements for critical industrial infrastructure.
- **GDPR:** Strict operational privacy controls across all administrative layers.
- **EU AI Act:** Full compliance via Human-in-the-Loop governance, traceable audit logs, and deterministic risk mapping.
- **C. Enterprise Integration (REST API & Industrial RAG):**
 - **Secure REST API:** Encrypted connectivity to corporate ERP, MES, and SCADA architectures.
 - **Industrial RAG Engine:** Real-time semantic grounding across technical machinery manuals (DTRs, electrical schematics) using SHA-256 cryptographic hashing to maintain auditability.

SECTION 2: TECHNICAL & HARDWARE ARCHITECTURE

2.1. System Topology: Sovereign Edge vs. Elastic Cloud GPU

ECAi resolves the deterministic real-time control dilemma while retaining access to high-parameter AI models:

1. Edge Layer (Autonomous Line Execution):

- **100% Air-Gapped Operation:** The ECAi Industrial Black Box installs directly inside machine control cabinets (DIN rail/Rittal mounts).
- Operates an embedded, deterministic mathematical engine.
- Executes continuous signal triage, financial quantification, and failure prediction locally in sub-5 ms latency (1–4 ms), remaining operational during plant network outages.

2. Cloud Deep Reasoning Layer:

- GPU mesh connections (Aethir Edge / Axe Compute) are triggered exclusively for asynchronous processing of complex, multi-variable events, deep causal reasoning via DeepSeek-V4, and Digital Twin model weight updates.
- Data transmitted via encrypted VPN tunnels under strict Zero Data Retention policies.

FACTORY FLOOR / MACHINE-SIDE CABINET

- ├─ Robotics / Welding (e.g., KUKA KR210)
- ├─ CNC Machining Cells (e.g., HAAS, Mazak)
- ├─ Presses / Molding & Vision Systems
- | Profinet, Modbus, OPC UA, Logs, API



ECAi INDUSTRIAL BLACK BOX (EDGE TIER)

Hardware: NVIDIA Jetson AGX Orin 64GB / Jetson Orin Nano (Neosys IP66)

- Universal Ingestion Module (Power & Signal Center)
- Edge Signal & Log Triage Engine (Proprietary Embedded Logic)
- Real-Time Financial Loss Quantification (€ / PLN)
- Industrial Determinism: 1-4 ms Latency (Full Air-Gapped Operation)
- | Selective Critical Offload
- | AES-256 Encryption / Zero Retention



SECURE DEEP REASONING GPU TIER (ISOLATED CLOUD)

- Decentralized GPU Mesh: Aethir Mesh / Axe Compute (NASDAQ: AGPU)
- Advanced Reasoning Engine: DeepSeek-V4 MoE Architecture
- Digital Twin Recalibration & Industrial RAG Knowledge Base
- Quantum Computing Readiness: IonQ Algorithmic Optimization Pipeline

2.2. Industrial Black Box Hardware Specifications

Engineered for harsh operating conditions (vibration, heat, dust, and electrical noise):

- **Compute Platforms:**
 - **NVIDIA Jetson AGX Orin 64GB Industrial:** Up to 275 TOPS for complex robotic cells and integrated lines.
 - **NVIDIA Jetson Orin Nano:** Up to 40 TOPS for single-station machines and compact setups.
- **Chassis & Protection (IP66 Rating):**
 - Rugged fanless enclosure (Neosys NRU-240S-AWP-JA064) engineered to withstand dust and oil vapors.
 - 24V DC industrial power input with redundant UPS backup to prevent memory corruption during factory power drops.
 - M12 screw-lock connectors ensuring physical signal integrity under mechanical shocks.

2.3. Agnostic Data Ingestion & Multi-Protocol Handling

Connects across legacy and modern automation stacks (Siemens, Fanuc, KUKA, Mitsubishi, Bosch Rexroth):

- **Fieldbus Connectivity:** Direct ingestion of Profinet, Modbus TCP, OPC UA, and EtherNet/IP packets.
- **Plant Information Systems:** Secure ingestion of MES, SCADA, and ERP (SAP) logs via encrypted REST API / Webhooks.
- **Signal Support:** Continuous sensor data, raw machine text logs, power consumption curves (MWh), and physical state variables.

2.4. Core Software Modules

1. **Power & Signal Ingestion:** Buffers real-time streams in volatile RAM, verifies packet checksums, and filters industrial electrical noise.
2. **Edge Triage Pro:** Embedded engine separating normal machine cycles from Warning, High, and Critical operational anomalies.
3. **Predictive Maintenance Module:** Monitors mechanical wear across bearings, spindles, and drives (e.g., KUKA Robot Axis-3).
4. **Loss Intelligence Engine:** Real-time formula mapping unplanned downtime seconds, electrical surges, or axis drift into direct financial losses (€/PLN).
5. **DeepSeek-V4 Reasoning Pipeline:** Asynchronous cloud interface for causal root-cause analysis of complex cascading failures.

2.5. Technology Roadmap: Photometry & Quantum Computing

- **Vision & Photometry Add-On (Laboratory Validation -> Field Release):**
 - Integration of industrial high-resolution cameras (Basler ace) with calibrated LED lighting.
 - DeepSeek-V4 Vision models deployed for automated weld seam profiling, micro-crack detection, and surface finish inspection.

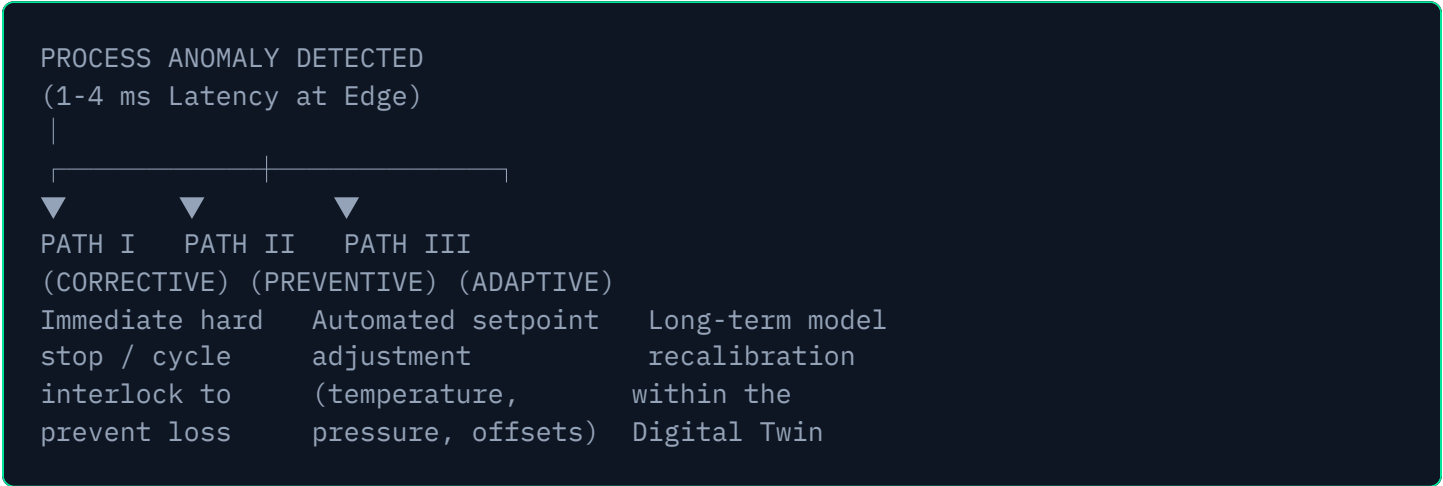
- **Quantum Computing Integration (IonQ Ready):**

- Formatting multi-machine telemetry streams to support hybrid combinatorial optimization algorithms on IonQ trapped-ion quantum architectures, targeting factory-wide scheduling bottlenecks.

SECTION 3: OPERATIONAL INTELLIGENCE, 3-PATH REMEDIATION & BUSINESS IMPACT

3.1. The 3-Path Remediation Matrix

ECAi replaces static alarms with deterministic, real-time remediation paths:



- **Path I: Corrective (Immediate Loss Mitigation):** Interlocks the machine cycle or issues an immediate STOP command to protect capital assets during critical events.
 - **Example:** Welding current spikes to 15,890 A while air pressure drops below 62.1 PSI; line stops to prevent torch destruction and defective parts.
- **Path II: Preventive (Process Parameter Trimming):** Recommends or applies parameter offsets in real time before tolerances are exceeded.
 - **Example:** In-process detection of a +0.42 mm Z-axis thermal drift on a CNC mill triggers a tool offset correction.
- **Path III: Adaptive AI (Digital Twin Evolution):** Aggregates machine wear patterns to adjust dynamic acceleration curves, extending asset lifecycles without sacrificing production speed.

3.2. Real-World Field Validation (Case Studies)

Empirical data validated via industrial testing (Reference: ECAi-SM-20261016-0017):

- **Scenario A: Robotic Welding Cells (ROB-WELD-04, WELD-04):**
 - **Incident:** Voltage surge and line pressure drop (91.2 to 62.1 PSI), driving axis temperatures to 61.2°C.
 - **Reaction:** Edge detection in 1 ms, quantifying risk and preventing servo drive failure.
 - **Financial Result:** €43,500 protected capital on a single event; 1,200 kg CO₂ emissions avoided.
- **Scenario B: High-Precision CNC Machining (CNC-07, HAAS-2):**
 - **Incident:** +0.42 mm thermal drift on the Z-axis combined with a coolant pressure

sensor timeout.

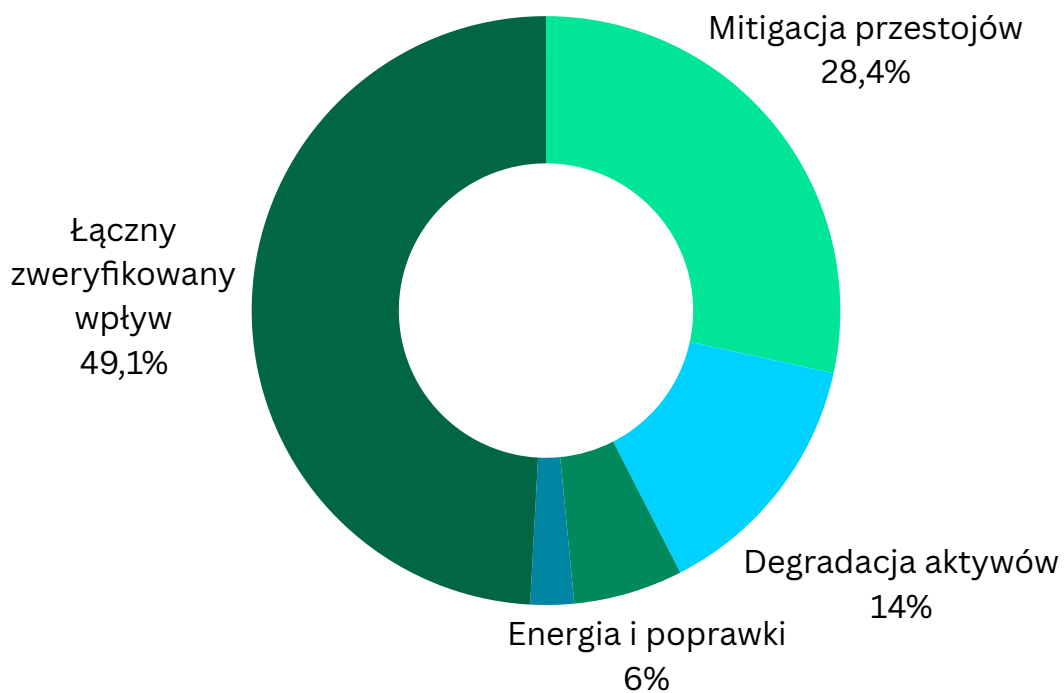
- **Reaction:** Path II preventive notification delivered in 7 ms prior to final finishing passes.
- **Financial Result:** Averted scrap production on high-value gear housings, saving €4,000 to €18,240.
- **Scenario C: Predictive Mechanical Degradation (KUKA KR210_A3):**
 - **Incident:** Axis-3 micro-vibrations and torque friction anomalies indicating impending bearing failure.
 - **Reaction:** Early warning allowed maintenance to schedule a bearing replacement during a planned weekend window.
 - **Financial Result:** Eliminated unplanned downtime with protected capital valued at €8,700 to €15,000 per station.

3.3. Quantified Loss Intelligence

Field data across 10 monitored industrial production assets:

Protection Category	Incident Count	Capital Protected (€)	Calculation Foundation
Downtime Mitigation	15	€108,465	Cost of prevented unplanned line stoppages.
Asset Degradation	17	€53,610	Prevented spindle, servo, and bearing destruction.
Energy & Rework	14	€22,926	Eliminated out-of-spec operational cycles.
Material Scrap	6	€9,145	Prevented defective scrap material.
TOTAL VERIFIED IMPACT	17	€187,583	Total operational capital saved.

Zweryfikowany wpływ strat



Źródło: dane wygenerowane przez AI. Przed użyciem sprawdź i w razie potrzeby popraw.

3.4. Decarbonization and ESG Impact

- **Energy Conserved:** 61.9 MWh in electrical energy saved during test cycling.
- **Carbon Emissions Avoided:** 34,640 kg CO_2 (34.64 metric tons) verified emissions reduction across 10 monitored assets.
- **Automated Audit Exports:** Real-time generation of Scope 1 and Scope 2 energy efficiency certifications for regulatory reporting.

€187,583

Total Verified Impact

61.9 MWh

Energy Saved

34,640 kg

CO_2 Avoided

SECTION 4: BUSINESS MODEL, UNIT ECONOMICS & FINANCIAL PROJECTIONS

4.1. Revenue Architecture (Hybrid Hardware-Enabled SaaS)

- **CAPEX (One-Time Setup Fee):**
 - **€50,000 per line:** Covers industrial IP66 edge hardware (NVIDIA Jetson AGX Orin / Orin Nano), cabinet installation, fieldbus integration, and Digital Twin initialization.
- **OPEX (Recurring Monthly Subscription):**
 - **€15,000 / month per line (€180,000 ARR per line):** Software licensing, edge analytics, cloud GPU reasoning, and 24/7/365 SLA technical support.
- **Entry Commitment:**
 - **€65,000 initial package:** Setup fee plus the first month of continuous SLA operations.

4.2. Multi-Line Enterprise Tiering

To support plant-wide adoption, tiered packages incentivize complete factory rollouts:

Deployment Tier	Line Count	Setup Fee (CAPEX)	Monthly Subscription (MRR)	Annual Recurring Revenue (ARR)
Pilot Line	1	€50,000	€15,000	€180,000
Production Cell	3	€135,000 (10% off)	€40,500	€486,000
Plant Section	5	€200,000 (20% off)	€60,000	€720,000
Full Facility	10	€350,000 (Enterprise)	€110,000	€1,320,000

4.3. Unit Economics & Gross Margins

The Edge-First model shifts computation to local hardware, keeping external bandwidth and cloud inference costs low:

- **Hardware Setup Margin:** >65% gross margin on setup and hardware delivery.
- **Cloud & GPU COGS:** Selective offload keeps recurring cloud infrastructure costs under 15–20% of subscription revenue.
- **Recurring SaaS Gross Margin:** 80–85%, aligning with enterprise software margins.

80–85%

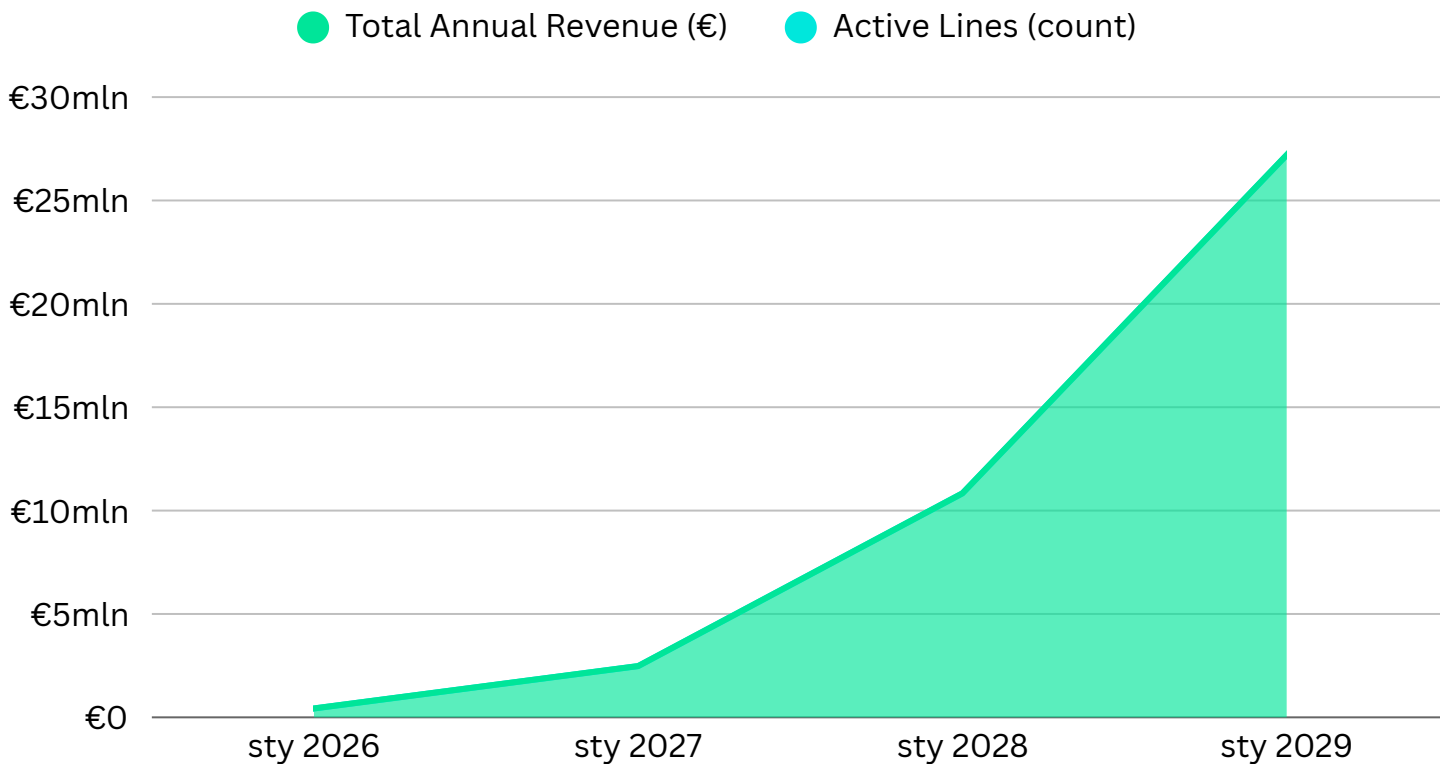
€15,000 / month

4.4. Scaling Trajectory to €25,000,000 ARR

The 2026–2029 growth trajectory reaches €25M ARR by deploying **138 to 140 industrial lines**, equivalent to standardizing across 14 to 20 mid-to-large automotive plants:

Growth Year	Client Facilities	Active Lines	Setup Revenue (€)	ARR Subscription (€)	TOTAL ANNUAL REVENUE (€)
2026 (Incubation / Pilots)	1	2	€70,000	€360,000	€430,000
2027 (Commercial Launch)	4	12	€500,000	€1,980,000	€2,480,000
2028 (EU Expansion)	15	55	€1,925,000	€8,910,000	€10,835,000
2029 (Market Maturity)	30	140	€4,900,000	€22,300,000	€27,200,000

Skok przychodów wraz z rozwojem linii



Źródło: dane wygenerowane przez AI. Przed użyciem sprawdź i w razie potrzeby popraw.

4.5. Value-to-Price Validation

- A typical 10-line plant captures **€178,438 in protected capital** during initial operational benchmarking.
- Individual critical incidents avert up to **€43,500 in direct loss**.
- The system offsets its annual software subscription by mitigating 1 to 2 major production stoppages, delivering an annual client ROI between 300% and 500%.

SECTION 5: INTELLECTUAL PROPERTY (IP) ASSET REGISTRY & VALUATION FRAMEWORK

5.1. Registered IP Asset Inventory

The company's core valuation rests on proprietary algorithmic and architectural assets:

1. **Core Execution Engine IP:** Proprietary source code for the ECAi Autonomous Engine v4.0–v5.0 Pro, sub-5 ms deterministic edge triage logic, and the Universal Ingestion Module.
2. **Process IP (3-Path Remediation):** Mathematical formulas converting raw sensor deviations into real-time financial loss indicators (€/PLN).
3. **Digital Twin & Tribal Knowledge IP:** Dynamic correlation engine codifying human operational experience into algorithmic parameters.
4. **Institutional Registration:** Formally registered under the European Funds for Eastern Poland Program (Application No. FEPW.01.01-IP.01-1528/26).

IP Asset Inventory

Core Execution Engine IP; Process IP (3-Path Remediation); Digital Twin & Tribal Knowledge IP; Institutional Registration.

5.2. Valuation Realignment (Public Grants vs. Commercial Value)

Grant-related filings utilize conservative, cost-based estimates (e.g., €1,200/month IP access fees) to satisfy administrative requirements. Commercial Enterprise valuation is based on economic value generation (Value-Based Pricing): protecting hundreds of thousands of euros in capital justifies commercial pricing of €50k setup and €15k/month per line.

5.3. Enterprise Valuation Framework

Based on transaction multiples across industrial AI and critical enterprise software (5x to 15x ARR):

- **Interim Benchmark (Year 2 – €10.8M ARR):**
 - **Baseline Multiple (8x ARR):** €86,400,000.
 - **Growth Multiple (12x ARR):** €129,600,000.
- **Scale Target (Year 3 – €25.0M ARR across 140 lines):**
 - **Conservative Multiple (5x ARR):** €125,000,000.

- **Sector Benchmark (10x ARR):** €250,000,000.
- **Market Leader Multiple (15x ARR):** €375,000,000.

Interim Benchmark

Year 2 – €10.8M ARR: €86,400,000 at 8x ARR; €129,600,000 at 12x ARR.

Scale Target

Year 3 – €25.0M ARR across 140 lines: €125,000,000 to €375,000,000 at 5x to 15x ARR.

5.4. Certified Audit and Capitalization Roadmap

1. **Source Code Due Diligence:** Verification of source code originality, IP ownership, and zero open-source copyleft (GPL) contamination.
2. **Independent Audit & Valuation:** Relief-from-Royalty and Discounted Cash Flow (DCF) valuation conducted by certified auditing partners.
3. **Balance Sheet Capitalization:** Recognizing core software IP as intangible assets to expand credit capacity and support institutional funding rounds.

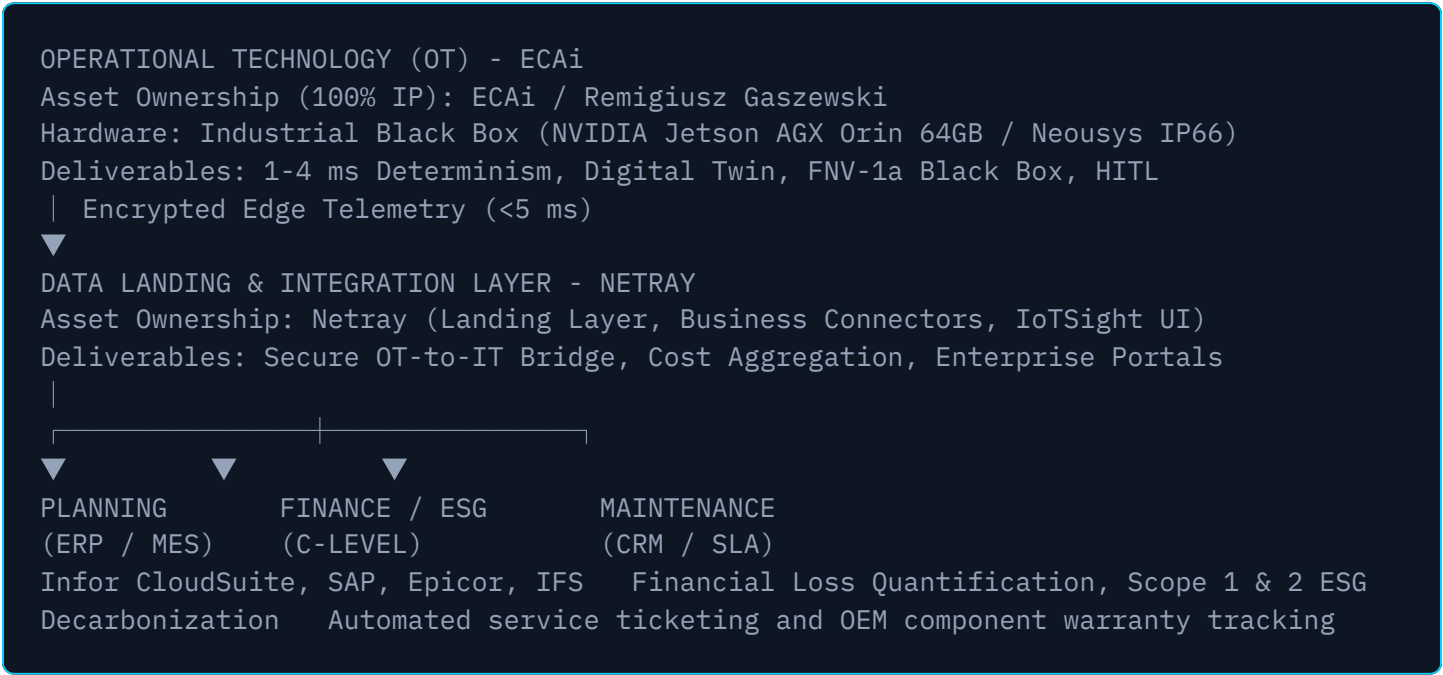
SECTION 6: STRATEGIC ALLIANCES, OT/IT/ERP INTEGRATION & COMMERCIAL ROADMAP

6.1. Technology Alliances

- **Hardware & Edge Tier (NVIDIA):** Standardized on NVIDIA Jetson AGX Orin 64GB Industrial units in Neousys IP66 chassis with M12 connectors, engaging through the NVIDIA ecosystem (GTC).
- **Decentralized Compute Tier (Aethir Mesh & Axe Compute):** On-demand GPU processing for DeepSeek-V4 MoE models under Zero Data Retention standards.
- **Industrial Validation Pipeline:** Ongoing engagement with enterprise operators, including KGHM, Cognor, and Grupa Kęty.

6.2. Strategic Partnership: Netray (OT-to-IT Bridge for Tier 2)

Commercial collaboration with Netray (under active NDA) targeting Tier 2 industrial manufacturers (150–1,000 employees):



- **Division of Responsibilities:**
 - **ECAi:** Full ownership of edge hardware, AI models, local reasoning, Digital Twins, and raw machine telemetry.
 - **Netray:** Data landing layer, ERP/CRM integration (Infor CloudSuite, SAP, Epicor, IFS), user interfaces (IoT Sight / EnergySight), and client account management.
- **Commercial Model & Revenue Share:**
 - **Standardized list price:** €50,000 CAPEX + €15,000 / month OPEX per line.
 - **Revenue split:** 70% ECAi / 30% Netray across software and commercial services.
 - **Combined Revenue Scaling:** A 1-plant deployment (10 lines) yields €2.3M in annual

revenue (€1.61M for ECAi); scaling to 10 plants (100 lines) generates €23M in annual revenue (€16.1M for ECAi / €6.9M for Netray).

- **IP Governance:** 100% of underlying software IP remains with ECAi; mandatory co-branding with non-compete clauses covering edge industrial AI.

6.3. Sector Integration: Raverk (Autonomous Solar-Thermal Desalination Containers)

Technology collaboration with German engineering startup **Raverk** (CEO: Ivan Toma), integrating ECAi inside transportable, modular solar-thermal water desalination units (ALPHA-1, 40ft High Cube Container):

- **Autonomous Operating Engine (ECAi Edge Inside):**
 - The ECAi edge appliance installs in the Raverk automation cabinet, replacing legacy static PLC logic with dynamic thermodynamic optimization.
 - Real-time adjustment of multi-effect vacuum distillation stages based on direct solar irradiance (DNI) and sand-based thermal storage levels.
- **Precipitation Prediction (Targeted Salt Recovery):**
 - Real-time monitoring of pressure, temperature, and brine saturation to prevent mineral scale build-up inside copper heat-exchange loops.
- **Digital Twin of Mass & Energy Balance:**
 - Continuous modeling of solar-to-water conversion curves targeting daily outputs of 12 to 23 m³/day.
- **Financial & ESG Quantification:**
 - Real-time calculations of Levelized Cost of Water (LCOW) and operational carbon offsets relative to diesel-powered generators.
- **Target Deployments:** Arid manufacturing hubs, remote mining camps, and agricultural operations across MENA (UAE, Saudi Arabia Vision 2030), Chile, and Australia.

6.4. Standard Pilot Deployment Framework (6–8 Weeks to Launch)

Structured engineering process for plant deployments:

Phase	Duration	Scope of Work	Critical Milestone
Phase 1	Weeks 1–2	Procurement and delivery of the Jetson AGX Orin 64GB IP66 appliance, 24V power supplies, and M12 cabling.	Hardware ready for configuration.
Phase 2	Weeks 2–3	JetPack OS configuration, TensorRT model weight compilation, and fieldbus protocol setup	