

PERSONAL INFORMATION

First Name

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Last Name

Klos

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Timezone

Europe/Warsaw

APPLICATION FORM: PHOTIN

Application Form: PhotonQBoost Open Call for Solutions, Missions, Trainings and Services

This is the official tool for SMEs applying for PhotonQBoost's Open Call. Applicants must carefully read the [Guidelines for Applicants](https://photonqboost.eu/wp-content/uploads/2025/11/PhotonQBoost_Guidelines_For_Applicants_OC2-2025-1.pdf) before completing the form. Please note that each question has a maximum word limit, and concise, clear descriptions are encouraged.

1. Contact Information

1.1. Main Contact Information

First name:

Krzysztof

Last name:

Klos

E-mail:

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Phone number & country code:

+48727170038

Position / role:

CEO

1.2. Legally Responsible Contact Information

First name:

Krzysztof

Last name:

Klos

E-mail:

kk@photin.eu

Phone number & country code:

+48727170038

Position / role:

CEO

2. Organisation information:

Organisation legal name:

Photin sp. Z O.O.

Organisation short name:

Photin sp. Z O.O.

Country:

Poland

Legal address:

Marii Curie-Sklodowskiej 39/24

Website:

www.photin.eu

VAT number / Tax registration number:

PL7010980653

Registration date:

2020-04-30

Describe your SME, including its core products, services and activities and explain its connection, or interest in the Photonics or Quantum technology fields. Highlight any relevant applications, technology interests, or ongoing initiatives:

Photin is an SME dedicated to the advancement of photonics through the growth of III-V semiconductors using Metal-Organic Chemical Vapor Deposition (MOCVD), the industrial workhorse for III-V photonics. Our core activity is the development and production of high-performance Infrared (IR) detector materials, targeting extended Short-Wavelength Infrared (eSWIR) and Mid-Wavelength Infrared (MWIR).

Core Products & Services:

Photin's unique value proposition is its experience in MOCVD growth of antimonides. Unlike the majority of the market, which relies on Molecular Beam Epitaxy (MBE), Photin utilizes MOCVD to achieve superior semiconductors for uncooled or minimally cooled applications. Photin is the only company in the European Union that has developed state-of-the-art InAs-InAsSbP growth technology using MOCVD, which is applicable to detectors and emitters. Our primary products include epitaxial wafers and device prototypes used in industrial process control, environmental gas sensing. In 2024, MWIR detectors fabricated from Photin wafers by the Military University of Technology (WAT) outperformed leading commercial benchmarks from Hamamatsu, Teledyne-Judson, and VIGO Photonics in uncooled shunt resistance—a key performance metric.

Circular Economy & Sustainability:

Photin exemplifies the Circular Economy within the deep-tech sector. We acquire, repair, and repurpose MOCVD equipment phased out by Western universities and corporations. By upgrading it with modern control systems, we reduce the carbon footprint of semiconductor manufacturing and lower the barrier to entry for deep-tech R&D in Europe.

Connection to Photonics & Quantum Fields:

Photin provides the core epitaxial semiconductors without which photonic IR devices cannot be built. In the Quantum field, we plan to develop InAs electron-Avalanche Photodiodes (e-APDs). These ultra-low-noise components are essential for next-generation quantum sensing, quantum key distribution, and high-speed optical communications. e-APDs embody the characteristics of an ideal APD—unlike all other APDs, e-APDs are not restricted by the gain-bandwidth product limit.

Ongoing Initiatives (2025 Progress):

Throughout 2025, Photin conducted intensive preparations to transition from "proof-of-concept" to "industrial readiness." Purchase and qualification of an HR XRD tool now allows rapid measurement of layer mismatch and strain. An introduced in-situ monitoring

spectrometer provides live insight into the growth process: surface roughness, refractive index of grown layers (composition), and growth rate, including prebake, deoxidation, and cool-down stages. The best samples undergo extensive characterization utilizing Deep Level Transient Spectroscopy (DLTS), temperature-dependent photoluminescence (Room Temperature to 77K) to map bandgap emissions, and SIMS for gaining deep understanding of parameters responsible for device performance. We continue our partnership with WAT (Poland) for device processing and conducted development of InP/InGaAs APDs to verify background doping. Photin is now ready to scale its disruptive technology from TRL6 to TRL7/8 and reach yields that ensure high profitability.

Technology Interests:

Photin is actively pursuing three development tracks: (1) optimization of InAs-InAsSbP heterostructures for room-temperature MWIR detection, (2) extension to longer wavelengths via InAsSb on GaSb for thermal imaging, and (3) development of e-APD structures for photon-counting applications in quantum technologies. These initiatives position Photin at the intersection of classical photonics and emerging quantum sensing markets.

3. Grants

Which grant(s) are you applying for?

Solutions, Missions, Trainings & Services

Solution Title:

Industrial Scale-up of MOCVD-Grown MWIR Detectors via Advanced Process Control

Solution Technology Readiness Level:

6

Solution short description:

Harnessing the power of Photonics and Quantum technologies requires high-performance, affordable IR detectors—from standard PIN photodiodes to SPAD/APD/eAPD devices used in quantum applications.

In 2024, Photin demonstrated MOCVD-grown InAs-InAsSbP wafers which, processed by Military University of Technology, outperformed commercial competition in uncooled, unbiased operation. This confirmed that MOCVD physics yields superior devices, advancing Photin's proof-of-concept to TRL6.

However, yield instability limited the number of wafers delivered to market. In 2025, Photin addressed this through ~30 calibration runs, benchmarking the reactor with InP/InGaAs standards to eliminate hardware leaks and background doping, and integrating an in-situ spectrometer for real-time growth monitoring.

The QBoost solution capitalizes on this 2025 preparation. The primary objective is a (1) targeted InAs-InAsSbP (~3.5 μ m) growth campaign applying the validated "Golden Recipe" from 2024, refined using in-situ control and rapid HR-XRD feedback. Wafers meeting lattice-mismatch and surface-roughness specifications will be transferred to processing partners to fabricate devices demonstrating stable yield >50% (primary KPI). Resulting chips will be benchmarked against commercial specifications from leading competitors.

Secondary objective include exploratory growth runs of: (2) GaSb-based InAsSb-InAsSbP (~4.8 μ m) for extended MWIR coverage. Other objectives are (3) InP/InGaAs PIN structures for telecom-wavelength applications, and (4) visible-spectrum AlGaInP for LED applications—validating Photin's reactor versatility.

Successful execution transitions Photin from technology demonstrator to reliable supplier, unlocking the market for affordable, uncooled MWIR sensors serving industrial and environmental applications.

Describe how the solution will improve your SME's sustainability, resilience and productivity, and explain how it will generate measurable economic, environmental, and social benefits, including improvements in energy efficiency, reductions in greenhouse gas emissions, and positive impacts on the Photonics and Quantum industries:

Value Chain Impact:

Each Photin wafer generates significant value through the photonics supply chain: InAs substrate (500 EUR) → epitaxial wafer (4,000 EUR) → 2,000 chips per wafer (20 EUR each) → packaged detectors (50-100 EUR each). A single wafer creates ~100-200k EUR upstream value.

Sustainability and Environmental Benefits:

Photin's solution directly contributes to the EU Green Deal through both its product applications and its manufacturing philosophy.

1. **Methane Detection:** The MWIR InAs and InAsSb detectors developed in this project are ideally suited for monitoring CH₄(methane) and CO₂ absorption lines. Methane is a potent greenhouse gas. Affordable, uncooled sensors are critical for widespread deployment in gas infrastructure monitoring. By enabling wider access to these sensors, Photin contributes to the reduction of greenhouse emissions.
2. **Energy Efficiency in Industry:** These detectors serve as high-speed pyrometers in Advanced Manufacturing (glass, plastic, metallurgy). Precise, remote temperature control allows factories to optimize heating processes, significantly reducing energy consumption in heavy industry.
3. **Circular Production:** Photin operates refurbished MOCVD reactors, most cost efficient in terms of energy consumption in small scale production. Extending the life of high-tech capital equipment reduces the embodied energy and waste associated with manufacturing new semiconductor tools.

Resilience and Sovereignty:

Currently, the supply chain for high-performance IR epitaxy is dominated by US and Asian manufacturers, or established EU players using expensive MBE technology. Photin is the only EU entity demonstrating state-of-the-art InAs-InAsSbP MOCVD technology. InAs-InAsSbP products are currently dominated by Russian companies.

By stabilizing the yield of this process, Photin enhances European resilience by providing a sovereign, domestic source for critical dual-use materials. This reduces dependence on non-EU imports and insulates European integrators from geopolitical supply chain disruptions. The project moves the company from a fragile R&D startup to a resilient manufacturer with a verified production process.

Productivity and Economic Impact:

In 2025, Photin invested heavily in "cycle-time" and insight improvements

(characterization, process control, in-situ etching) rather than just trying grow more wafers. This Solution leverages that investments to boost productivity. By using *in-situ* monitoring to prevent failed runs before they finish, or in-situ etching to “correct” process faults and grow layer again in the same run, we maximize the yield of usable wafers per euro spent on precursors, substrates and cycle-time.

Economically, each Photin detector produced in the EU generates a positive trade balance (exporting deep-tech components). Success in this project allows Photin to enter the photonics market for industrial automation sensors, generating revenue to support high-tech jobs in Poland.

****Social and Ecosystem Impact:****

The project fosters the "Triple Helix" of innovation:

*** **Academia:** We collaborate with the Military University of Technology (WAT) and CEZAMAT for device processing, IMIF for SIMS metrology, and PWr for epitaxy development.**

*** **Industry:** We support local supply chains, purchasing high-purity gases, precursors, substrates, electronics components within the EU.**

*** **Workforce:** Developing this technology trains the next generation of MOCVD engineers in Poland, retaining talent within the European ecosystem.**

How innovative is your proposed solution compared to the current market, competitors and state of the art?

****The Physics Innovation: MOCVD vs. MBE****

The current State of the Art for MWIR detectors (made by Hamamatsu, Judson, and VIGO Photonics) relies on Molecular Beam Epitaxy (MBE) utilizing InAs/AlAsSb/AlGaAsSb structures. Bandgap alignment create valence band barrier in this material system, that block valence band holes current, requiring external bias or complex doping. These devices also have small dynamic resistance (Shunt Resistance) without bias or cooling, which reduce their responsivity. Also not publicly discussed and disseminated (key know how of specialists) are reliability issues with devices that contain high Al-content barrier layers.

Photin disrupts this paradigm by using MOCVD to grow ****InAs-InAsSbP**** structures. Unlike MBE, our MOCVD technology use of Phosphorus-based quaternary alloys without Aluminum. This achieves bandgap alignment that enable perfect photodiode opeation from ****zero bias**** (photovoltaic mode), resulting in significantly higher Shunt Resistance. In November 2024, our prototype detectors demonstrated Rshunt 200% higher than leading competitors (MBE), and also outperforming Russian InAs-InAsSbP products by (~30%). This proves our semiconductors device design and technology is physically superior for uncooled applications. InAs-InAsSbP without Al are much more reliable in harsh industrial application.

****The Process Innovation: From "Black Box" to "In-Situ Control"****

The core innovation of this proposal is the ****methodology of control**** developed throughout 2025. MOCVD of Sb-quaternary alloys is very challenging (phase separation and miscibility gap), which has been the barrier to market entry. Photin has disruptively solved technology problems by using low temperature metalorganics precursors:

1. ***Golden Reference of Best Devices*** We used SIMS (at IMIF) and DLTS + photoluminescence vs temperature (MUT) to study the doping profiles and trap states of our best 2024 wafer, creating a precise target specification.
2. ****Real-Time Feedback:**** We integrated a specialized spectrometer for ****in-situ monitoring****. Unlike standard "blind" growth, this allows us to observe the sensitive stages of growth like deoxidation, absorber smoothness, InAsSbP barrier formation in real-time and even adjust gas flows dynamically with immediate visible feedback.
3. ****Hardware Integrity:**** In 2025, we innovated our quality assurance by benchmarking our reactors with InP/InGaAs semiconductors. This allowed us to isolate and permanently fix micro-leaks that previously could cause yield variability.

****State of the Art Advancement:****

We are upgrading the Technology Readiness Level (TRL) from 6 (demonstrated) to 7

(system prototype demonstration in operational environment). While competitors have spent decades refining MBE, Photin is introducing a new, higher-performance semiconductor system to the market, enabled by modern process control that turns a difficult scientific art into reproducible industrial technology.

Describe your work plan for achieving the project outcomes, including key activities, resources, team members, and timeline:

****Agile Campaign Methodology:****

The project employs short 1-2 week growth campaigns, each producing 2-5 wafer variants. Promising samples undergo rapid test processing (~10 mesa dies, 1-week turnaround) to obtain I-V and responsivity feedback. This data determines whether to proceed to full quality processing (1-2 months) for market-ready chips. While awaiting characterization results, the reactor switches to different structure types, maximizing equipment utilization across the 6-month project.

****Four Growth Campaigns:**** 2x Prime (InAs 3.5 μ m and InAsSb bulk 4.8 μ m), 2x Supporting to use efficiently MOCVD while waiting for feedback from processing. Each sample rapid processing cost ~500 EUR.

Campaign	Structure	Target	Substrates
C1	InAs-InAsSbP	~3.5 μ m MWIR detectors	InAs
C2	GaSb-InAsSb-InAsSbP	~4.8 μ m extended MWIR	GaSb
C3	InP/InGaAs PIN	1.7 μ m telecom detectors	InP
C4	GaAs-InGaP-AlInGaP	Visible LEDs (red/orange)	GaAs

****Timeline: 6 Months****

****WP1: Preparation & Calibration (Month 1)****

* ****Activities:**** Procure substrates (InAs, InP, GaSb, GaAs ~5-8k EUR), MO precursors (Dockweiler, 10-15k EUR), process gases (2k EUR). Install moisture sensors (Czaki 3kEUR) ensuring dewpoint <-110°C.

* ****Key Resources:**** MOCVD reactor (leak-verified via 2025 InP benchmarking) undergoes bake-out and quartzware cleaning. MFCs validated by pressure-rise method. Ultrasonic bubblers switched from monitoring to active control mode for temperature-independent precursor delivery.

****WP2: Growth Campaigns (Months 2-5)****

* ****C1 - InAs-InAsSbP (Primary, Months 2-3, 5-6):**** Use 2024 "Golden Recipe" with in-situ spectrometer control. Target: 5+ wafers meeting XRD and surface specs. Success KPI criteria: >50% device yield after processing.

* ****C2 - GaSb-InAsSb-InAsSbP (Month 3-4):**** Extend MWIR capability to 4.8 μ m using GaSb substrates. Exploratory campaign validating Sb-rich quaternary growth. Target: 2-3

wafers.

*** **C3 - InP/InGaAs (Month 2, 4):** Grow PIN structures for telecom-wavelength validation. Leverages 2025 calibration work. Target: 2-3 wafers for responsivity benchmarking.**

*** **C4 - GaAs-AlGaInP (Month 4-5):** Visible-spectrum LED structures demonstrating reactor versatility for phosphide-based devices. Target: 2-3 wafers for PL characterization.**

*** Campaigns interleave based on characterization feedback—positive results trigger additional runs of that structure type.***

****WP3: Device Processing & Validation (Months 3-6, continuous)****

*** **Partners:** MUT (primary), IMIF, CEZAMAT, additional partners as capacity requires.**

*** **Activities:** Mesa fabrication (500µm diameter or other as market needed), photolithography, wet/dry etching, metallization.**

*** **Testing:** Dark current, spectral response, shunt resistance (R_shunt) at 300K.**

*** **Outcome:** Yield report correlating in-situ growth signatures, and post-growth characterization (XRD, PL, surface) with device performance; production baseline established.**

****Team Members:****

*** **Krzysztof Kłós (CEO/Lead Engineer):** 15+ years MOCVD experience. Reactor operation, recipe design, campaign prioritization.**

*** **Marcin Klimek (Process Technician, part-time via QBoost):** Reactor operations support, XRD characterization, facility maintenance, sample logistics.**

Include a Power Point presentation of up to 15 slides to support your application:

https://dl.acceleratorapp.co/file/2025_05_Pitch-Photin_V3_yNvfAiFwqufb5Y2xNNADY.pdf

If applicable, include a letter of commitment from organisations that are supporting your application:

https://dl.acceleratorapp.co/file/final_LOI_8jiNDp_53A27d6zAl997o.pdf

Which mission(s) are you applying for?

Germany (Stuttgart, October 8-9, 2026 – Mobility)

Describe your motivation to participate in the mission(s), considering your SME's innovation goals and expected outcomes:

Photin is highly motivated to participate in the Stuttgart Mobility Mission because the Photonics BW network includes numerous semiconductor companies and university research groups with whom Photin has established relationships. We acquired MOCVD reactors from both Stuttgart University and Ulm University, creating natural channels for renewed collaboration. Several Photonics BW member companies have expressed interest in Photin's capabilities: DILAS (now Coherent) is a fabless laser diode manufacturer seeking epitaxy partners; 21Semiconductors operates in related III-V markets; nLight produces high-power lasers requiring specialized epitaxy. Additionally, Bosch maintains an active PICs development department, and SICK manufactures continuous emissions monitoring systems—both representing potential end-users for Photin's detector technology.

The Photonics BW ecosystem represents one of the largest potential markets for our SWIR/MWIR detector and laser epitaxy technology.

As the automotive industry moves towards higher levels of autonomy (L3/L4/L5), the limitations of current visible-light cameras and LiDAR in harsh weather conditions (fog, rain, dust) have become apparent.

****Innovation Goals:****

Our goal is to position Photin's epitaxy growth capabilities and uncooled InAs MWIR sensors as the solution for MWIR spectrometers, pyrometers and open communications, as MWIR light penetrates fog and scattering media far better than visible light or near-infrared (NIR). By attending this mission, we aim to seek partners and market insight.

****Expected Outcomes:****

- 1. **Market Validation:** We intend to gather direct feedback on the required specifications (wavelength, dark current, responsivity, size, package, cost) for SWIR/MWIR sensors among Stuttgart mission participants.**
 - 2. **Networking:** Establishing contact with R&D engineers at major photonics companies to explore pilot projects where our sensors could be tested in new applications.**
 - 3. **Partnerships:** Identifying potential integration partners who can package our raw chips into end-use modules.**
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How does your SME's activities and value proposition align with the mission's thematic focus?

The Stuttgart mission focuses on the Mobility Sector, which encompasses automotive manufacturing, autonomous driving, mobile gas sensing and monitoring transport infrastructure. Photin's activities align perfectly with three critical pillars of this theme:

1. **Autonomous Sensing (Safety):**

Photin produces sensors that "see the invisible." In the mobility sector, reliable perception is non-negotiable. Standard cameras fail in dense fog or blinding sun glare. Photin's MWIR detectors, could become MWIR arrays, that offer thermal and spectral contrast that functions day and night, through obscurants. This aligns with the mission's focus on next-generation safety and autonomy.

2. **Advanced Manufacturing (Production):**

Stuttgart is a hub for high-tech manufacturing and Photonics BW has many interesting members. Photin's MWIR detectors are not just for gas sensing use, but for making. They are used in high-speed pyrometry to monitor the temperature of metal welding, plastic injection molding, and glass forming in real-time. Our value proposition of "uncooled, high-speed sensing" supports the "Industry 4.0" aspect of the production chains.

3. **Environmental Monitoring (Emissions):**

The mobility sector is under pressure to monitor exhaust and fugitive emissions. Our InAsSb sensors are tuned to detect hydrocarbons and CO_2 . This aligns with the thematic focus on sustainable mobility and compliance with Euro 7 emission standards.

Describe your team and its ability to generate synergies and partnerships. Include the names and a short introduction of the participants (max 2 per mission):

Photin sends CEO that bridges the gap between deep semiconductor physics and commercial applications.

CEO visited Stuttgart area ~2022, when cooperating with local universities on purchasing MOCVD reactors, and know scientists and engineers from area working on semiconductors. This mission is excellent opportunity to refresh old contacts, and present new Photin developments, and seek customers and cooperation partners among huge German ecosystem of manufacturers of industrial equipment.

****1. Krzysztof Kłós (CEO & Lead MOCVD Engineer)****

Krzysztof combines over 15 years of hands-on epitaxy experience with business leadership. His technical depth allows him to answer detailed questions from Tier-1 R&D engineers regarding material limits and customization, while his executive role enables him to make immediate decisions regarding partnerships and non-disclosure agreements (NDAs). He is the ideal representative to build trust with technical partners in Stuttgart.

Thoroughly describe the requested training or service, specifying the scope, price, and provider:

Photin requests support for four critical trainings and one feasibility study service required to enhance our business and export capabilities.

****1. WSK (Internal Control System) Training****

*** **Provider:** Pakula Consulting and/or Centre for Certification of Quality (CCJ) at the Military University of Technology.**

*** **Scope:** This training covers the implementation of an Internal Control System (Wewnętrzny System Kontroli - WSK). It focuses on the legal framework for trading strategic goods, classifying dual-use items (such as IR detector wafers), and preparing the company for the external audit required to obtain the "General Export Authorization."**

*** **Price:** Pakula Consulting: WSK implementation 5,000 PLN + VAT, WSK certification (state exam) 4,100 PLN + VAT + auditor travel/accommodation. Alternative: CCJ initial certification audit 5,150 PLN + VAT. Total estimate: ~2,200 EUR.**

****2. JePPIX Photonic Integrated Circuits (PIC) Training****

*** **Provider:** JePPIX / Eindhoven University of Technology (Part of PhotonHub Europe).**

*** **Scope:** Technical course on InP-based PICs covering passive components (waveguides, couplers), active components (SOAs, lasers, detectors), design tolerances, and integration—enabling Photin to tailor MOCVD wafers for PIC foundries.**

*** **Price:** €800.**

****3. F-Gas Certificate for Entrepreneurs (Personnel Certification)****

*** **Provider:** Specialized Training Center in Warsaw (e.g., "KURS FGAZ").**

*** **Scope:** Training for CEO Krzysztof Kłós on the installation, maintenance, and servicing of refrigeration equipment containing fluorinated greenhouse gases (F-Gases). This is critical for maintaining the industrial chillers used to cool MOCVD reactors.**

*** **Content:** Thermodynamics, leak checking, recovery of refrigerants, EU regulations (BDO registration), and safety.**

*** **Outcome:** Passing the UDT (Office of Technical Inspection) exam to obtain the personal and company F-Gas Certificate.**

*** **Price:** 1,500-2,000 PLN (~€350-450).**

****4. NanoLund MOCVD Introduction Training & Lab Access****

*** **Provider:** NanoLund / Lund Nano Lab, Lund University (Sweden).**

*** **Scope:** This service comprises two components:**

*** **Introduction Training:** Hands-on course covering operation of close-coupled showerhead MOCVD reactors for III-V epitaxy on 3" and 4" wafers. Topics include reactor safety, gas panel operation, recipe programming, and in-situ monitoring interpretation.**

****Lab Access:**** Supervised access to NanoLund's MOCVD facility to perform test growths on larger diameter substrates (3"/4"), validating Photin's recipes on industrial-scale platforms.

****Learning Outcomes:**** Transfer Photin's 2" processes to larger formats; understand scaling challenges; establish EU research collaboration.

****Price:**** Introduction training 3,500 SEK; monthly access fee 1,500 SEK; MOCVD reactor 1,500 SEK/hour; characterization (PL mapper 580 SEK, HR-XRD 580 SEK per session). Estimated total: ~€3,000-4,000 for training + 2-3 growth runs with characterization.

****5. MEETOPTICS Market Feasibility Study (Product Listing Service)****

****Provider:**** MEETOPTICS LABS S.L. (Barcelona, Spain) - a specialized B2B photonics marketplace.

****Scope:**** This feasibility study validates commercial demand for Photin's MWIR detector products through professional market exposure:

****Product Listing:**** Annual listing of up to 50 Photin detector products.

****Market Analytics:**** Quarterly reports on visitor statistics, engagement metrics, and inquiry patterns.

****Promotion:**** Social media promotion and dedicated company profile page to increase visibility among photonics buyers.

****Sales Channel:**** Direct customer inquiries routed through the platform (15% commission on resulting sales).

****Price:**** €1,493

If applicable, include an external link to the training or service:

<https://pakulaconsulting.pl/WSK>, <https://www.jeppix.eu/pic-concepts-training/>

Describe the relevance of the proposed training or service in addressing your SME's current needs and objectives:

****1. WSK Training (Export Compliance):****

Photin's core products: wafers with III-V layers, is often classified as "Dual-Use" technology due to its military applications. To achieve our objective of expanding into non-EU markets (specifically the US, UK, and Switzerland), we are legally required to possess a WSK system and Export Authorization. Without this training and subsequent certification, Photin is effectively legally barred from exporting to our most lucrative potential customers. This service is a "license to operate" in the global market.

****2. JePPIX Training (Search for Customers and Partners in area of PICs development on InP):****

The photonics market is shifting from discrete components to Integrated Circuits (PICs). Currently, Photin sells discrete detectors and wafers. To remain relevant, we need to understand how to tailor our MOCVD growth to be compatible with PICs foundries. This training addresses the need to bridge the gap between our raw material manufacturing and the complex design rules of the integrated photonics ecosystem, opening new partnership opportunities with PIC designers.

****3. F-Gas Training (Operational Resilience):****

MOCVD reactors generate immense heat and require precise, uninterrupted cooling via industrial chillers containing F-gases. If a chiller fails, production stops immediately, and the reactor risks damage. Currently, we rely on external vendors for minor repairs, which causes delays. By certifying our CEO/Staff, Photin gains the legal authority and technical skill to perform immediate maintenance and leak checks in-house. This directly addresses the need for operational resilience and uptime maximization.

****4. NanoLund Training & Lab Access (Industrial Scaling):****

Photin's current MOCVD reactor is optimized for 2" wafers—suitable for R&D but insufficient for industrial-scale production. The semiconductor industry standard is migrating to 3" and 4" substrates, which offer 2.25x to 4x more die per wafer, dramatically improving cost efficiency. Without access to larger-diameter growth capability, Photin cannot serve volume customers or compete on price.

NanoLund operates state-of-the-art MOCVD systems capable of 3" and 4" epitaxy. This training and lab access addresses Photin's critical need to: (1) validate that our InAs-InAsSbP recipes scale to larger diameters with acceptable uniformity; (2) gain hands-on experience with industrial-grade reactor configurations; (3) establish a pathway for future contract epitaxy or equipment upgrade decisions. This service directly supports the

transition from TRL6 (2" demonstration) to TRL7/8 (industrial prototype on production-relevant substrates).

****5. MEETOPTICS Feasibility Study (Market Validation):****

Photin has demonstrated superior detector performance in the lab, but commercial success requires validating actual market demand. Before investing heavily in production scale-up, Photin needs data on: (1) which detector specifications attract buyer interest; (2) what price points the market will bear; (3) which application segments show strongest demand.

MEETOPTICS provides a low-risk feasibility study mechanism. By listing products on an established photonics marketplace, Photin gains access to qualified buyers actively searching for detection devices. The quarterly analytics reports provide objective market feedback—visitor counts, inquiry rates, and conversion metrics—enabling data-driven decisions about product positioning and production priorities. This service directly supports Photin's transition from R&D to commercial supplier by validating product-market fit before committing to volume manufacturing.

Describe how the training or service will be implemented in your SME, considering the impacted personnel, and timeframe:

****1. WSK Implementation:****

*** **Personnel:** CEO**

*** **Timeframe:** Immediate (Month 1-2).**

*** **Implementation:** Following the training, the management team will draft the internal WSK procedures and Manual. We will then schedule the external audit with CCJ. The ultimate implementation is the submission of the application to the Ministry of Development for the Export Certificate.**

****2. JePPIX Implementation:****

*** **Personnel:** CEO**

*** **Timeframe:** Scheduled JePPIX course dates (typically annual/bi-annual).**

*** **Implementation:** The knowledge gained will be immediately applied to our R&D roadmap. We will review our current wafer specifications to assess compatibility with JePPIX standards. The attendee will conduct an internal workshop to transfer key "Design for Manufacturing" concepts to the rest of the team.**

****3. F-Gas Implementation:****

*** **Personnel:** Krzysztof Kłós (CEO).**

*** **Timeframe:** 1-week intensive course + UDT Exam (Month 1).**

*** **Implementation:** Upon passing the exam and receiving the certificate, the company will register in the Central Register of Operators (CRO) and BDO. We will purchase the required minimum technical equipment (leak detector, manifold gauges) to legally perform in-house maintenance. This allows us to institute a preventative maintenance schedule for our chillers, independent of external contractors.**

****4. NanoLund Implementation:****

*** **Personnel:** Krzysztof Kłós (CEO/Lead MOCVD Engineer).**

*** **Timeframe:** Month 3-4 (after initial QBoost growth campaign on 2" wafers).**

*** **Implementation:** Complete online safety and facility orientation (pre-requisite). Travel to Lund for 3-day intensive training on MOCVD operation. Perform 2-3 supervised growth runs of InAs-InAsSbP structures on 3" substrates using adapted Photin recipes. Characterize resulting wafers (XRD, PL mapping) to assess uniformity. Document scaling parameters and lessons learned for internal knowledge transfer and future equipment specification.**

****5. MEETOPTICS Implementation:****

*** **Personnel:** Krzysztof Kłós (CEO).**

*** **Timeframe:** Month 1-2 (concurrent with initial growth campaigns).**

*** **Implementation:** Prepare product specifications and datasheets for up to 50 detector products (InAs-InAsSbP, InAsSb variants, different chip sizes and packages). Submit specifications to MEETOPTICS for platform integration (3-5 weeks). Review and approve product listings before publication. Monitor quarterly reports and adjust product offerings based on market feedback. Track inquiries and conversion rates as KPIs for market validation success.**

What are the expected qualitative and quantitative impacts of the training or service, including its contribution to your SME's sustainability, resilience, and to the photonics/quantum sectors?

1. WSK Training (Export Compliance):

Quantitative: Enables access to non-EU markets (US, UK, Switzerland) representing ~60% of the global IR detector market. Without WSK certification, and Export Permits Photin need to use expensive distributors for exports, which reduce severely profitability. Target: 3-5 international customers within 12 months of certification.

Qualitative: Establishes Photin as a trusted, compliant supplier for defense and dual-use applications, building institutional credibility essential for long-term B2B relationships.

2. JePPIX PIC Training:

Quantitative: Opens partnership opportunities with 15+ European PIC foundries. Target: 1-2 pilot projects integrating Photin epitaxy into photonic circuits within 18 months.

Qualitative: Positions Photin at the intersection of discrete components and integrated photonics—the fastest-growing segment of the photonics market. Understanding PIC design rules enables Photin to tailor wafer specifications for foundry compatibility.

3. F-Gas Certificate:

Quantitative: Reduces chiller maintenance response time from 3 days (external vendor) to same-day in-house repair. Prevents ~5-10 days of annual production downtime, equivalent to 2-4 additional growth campaigns worth ~€20,000 in potential revenue.

Qualitative: Eliminates single-point-of-failure dependency on external contractors, directly enhancing operational resilience.

4. NanoLund MOCVD Training & Lab Access:

Quantitative: Validates recipe scalability from 2" to 3"/4" wafers, increasing die yield per wafer by 2.25-4x. A single 4" wafer produces ~4,000 chips versus ~1,000 on 2", dramatically

improving unit economics. Target:

Demonstrate uniform 3" wafers growth with <5% thickness variation.

Qualitative: Establishes collaboration pathway with premier EU research infrastructure, positioning Photin for future contract epitaxy partnerships or equipment upgrade decisions.

5. MEETOPTICS Feasibility Study:

Quantitative: Provides measurable market validation data—visitor counts, inquiry rates, conversion metrics—across 50 product listings. Target: 10+ qualified inquiries and 2-3 sales leads within first year. Quarterly analytics enable data-driven product positioning.

Qualitative: Low-risk market entry mechanism validating product-market fit before committing to volume manufacturing investments into detector fabrication with expensive partners.

Contribution to Sustainability:

These services collectively reduce Photin's environmental footprint. F-Gas certification ensures proper refrigerant handling per EU regulations. Scaling to larger wafers (NanoLund) improves material efficiency—more devices per substrate means less waste per unit. Export certification (WSK) enables Photin to supply MWIR sensors for methane detection and emissions monitoring, directly supporting EU Green Deal objectives.

Contribution to Resilience:

The training portfolio systematically eliminates business vulnerabilities: legal barriers (WSK), operational dependencies (F-Gas), technology limitations (NanoLund), and market uncertainty (MEETOPTICS). Together, they transform Photin from a fragile R&D startup into a resilient commercial supplier with diversified capabilities and validated market demand.

Contribution to Photonics/Quantum Sectors:

Photin addresses a critical gap in European photonics sovereignty—domestic MOCVD-based MWIR epitaxy. By scaling production capability and achieving export compliance, Photin becomes a reliable EU source for III-V detector semiconductors

currently dominated by US, Asian, and Russian suppliers. JePPIX training specifically positions Photin to contribute to the emerging PICs photonics ecosystem, where low-noise IR detectors are essential for sensing and communication applications.

Include two quotations for your training or service. If not applicable, please justify why:

https://dl.acceleratorapp.co/file/trainings-merged_ykz_rLkc26wgP4nB2MSEv.pdf

Justification:

Justification for Single-Source Services:

Competitive quotes were obtained for WSK training (Pakula Consulting vs. CCJ) and F-Gas certification (multiple accredited training centers in Warsaw), as these are standardized compliance services with multiple qualified Polish providers.

However, three services have no equivalent alternatives in the EU market:

- NanoLund is a non-profit academic facility within Lund University offering the only open-access MOCVD training and lab access for III-V epitaxy on 3"/4" wafers in Europe.

Commercial MOCVD facilities do not offer external training or supervised access to competitors. No equivalent program exists at other EU universities with comparable reactor configurations.

- JePPIX is the designated European technology platform for InP-based photonic integrated circuits, established under EU funding (PhotonHub Europe). It is the sole provider of standardized PIC design training recognized by European foundries. Alternative courses do not exist - JePPIX defines the ecosystem standards.

- MEETOPTICS is the only specialized B2B marketplace dedicated exclusively to photonics components in Europe. Unlike general industrial distributors, MEETOPTICS aggregates qualified photonics buyers and provides sector-specific analytics. No competing platform offers equivalent market validation services for photonics SMEs in EU.

For these three services, single-source procurement is justified by market uniqueness rather than preference.

4. Eligibility Self-declarations

Are you a small and medium-sized enterprise according to the European Commission SME definition (Recommendation 2003/361/EC16)?

YES

Is your entity legally established in an EU Member State or a Horizon Europe Associated Country?

YES

Has your organisation been legally registered for at least 6 months prior to the Open Call deadline?

YES

Are you submitting only one application form under this Open Call on behalf of your organisation?

YES

Can you confirm that your organisation IS NOT a consortium partner or subcontractor involved in the PhotonQBoost project?

YES

Can you confirm that this proposal is unique, and has not received duplicate funding?

YES

Do you consent to data processing under Sploro's GDPR policy? (<https://sploro.eu/privacy-policy/>)

YES

4.1. Declaration of Honour

By submitting this form, I hereby certify that: The information provided for this project is truthful, correct and complete. The information concerning the legal status in the Application for my organisation is correct and complete and concurs with the stipulations outlined in the Guidelines for Applicants. My organisation commits to comply with the eligibility criteria set out in the call for proposals for the entire duration of the action. My organisation: • Is committed to participate in the action; • Has stable and sufficient sources of funding to maintain the activity throughout the action and to provide any counterpart funding necessary; • Has or will have the necessary resources needed to implement the action; My organisation: • Is NOT subject to an administrative sanction (i.e., exclusion or financial penalty decision). My organization is NOT in one of the following exclusion situations: • Bankrupt, being wound up, having the affairs administered by the courts, entered into an arrangement with creditors, suspended business activities or subject to any other similar proceedings or procedures; • In breach of social security or tax obligations. My organisation (or persons having powers of representation, decision-making or control, beneficial owners or persons who are essential for the award/implementation of the grant): are NOT in one of the following exclusion situations: • Guilty of grave professional misconduct; • Committed fraud, corruption, links to a criminal organisation, money laundering, terrorism-related crimes (including terrorism financing), child labour or human trafficking; • Shown significant deficiencies in complying with main obligations under an EU procurement contract, grant agreement or grant decision; • Guilty of irregularities within the meaning of Article 1(2) of Regulation No 2988/95; • Created under a different jurisdiction with the intent to circumvent fiscal, social, or other legal obligations in the country of origin (including creation of another entity with this purpose). My organisation is NOT subject to a conflict of interest in connection with this grant and will notify - without delay - any situation which could give rise to a conflict of interests. My organisation has NOT and will NOT, neither directly nor indirectly, grant, seek, obtain, or accept any advantage in connection with this grant that would constitute an illegal practice or involve corruption. My organisation has not received any other EU grant for this project and will give notice of any future EU grants related to this project. My organisation is aware that false declarations may lead to rejection, suspension, termination or reduction of the grant and to administrative sanctions (i.e., financial penalties and/or exclusion from all future EU procurement contracts, grants, prizes and expert contracts).

YES
