BEST PRACTICES FOR SMALL AND MEDIUM ENTERPRISES THROUGH THE EUROPEAN PROJECT M4M: MIND4MACHINES – MANUFACTURING INDUSTRY'S NOVEL DIGITALIZATION VALUE CHAINS FOR CONNECTING MACHINES WITH PEOPLE, PROCESSES AND TECHNOLOGY

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**MIND4MACHINES / M4M is a Horizon 2020 project financed by the European Commission, led by Istanbul Chamber of Industry (ICI) and it is a fusion between enterprise associations, SMEs clusters, research organizations, chambers of commerce and industry, and regional development agencies. The Project consortium is composed of 11 European partners from 8 European countries.*

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme – INNOSUP under grant agreement No 101005711

A. INTRODUCTION

Small and medium enterprises (SMEs) form the backbone of the European economy, yet many face challenges in leveraging cutting-edge technologies to drive growth and competitiveness. To address this critical need, the European project **M4M – Mind4Machines**, funded by the European Commission, has played a important role in demonstrating how advanced digital solutions can transform the manufacturing sector.

Coordinated by a consortium of nine countries, including Germany, Italy, Turkey, Romania, Ireland, Finland, Spain, Bulgaria and **IPA SA** as a key partner, M4M has successfully concluded in November 2024. The project developed and implemented innovative frameworks to showcase the potential of next-generation Information and Communication Technologies (ICT)—such as **IoT hardware and software, Big Data, Cloud Computing, Artificial Intelligence, Cybersecurity, and Advanced Automation Systems**—to revolutionize European manufacturing. Through these technologies, the project aimed to empower innovative SMEs, enabling them to thrive in a highly competitive, innovation-driven industrial environment. By creating scalable, practical demonstrations of digital solutions, M4M has helped position the manufacturing industry as a creative and resilient force capable of addressing current development challenges. The **MIND4MACHINES** project, funded by the European Union's Horizon 2020 (H2020) Research and Innovation Program – INNOSUP, under grant agreement No. 101005711. With a dedicated budget of €3.3 million, the project provides financial support through two **Open Calls**, utilizing an innovative cascade funding approach. For example, the first Open Call was launched on **April 27, 2022**, and closed on **June 29, 2022**, receiving a total of **202 project applications**. Following a rigorous evaluation process, **21 subprojects** were selected for funding: **18 under the Innovation Support Scheme** and **3 under the Go-to-Market Scheme**. Grants ranged from €30,000 to €120,000, with total funding amounting to **€1,621,450** distributed to SMEs. The Open Calls were structured around two financing schemes, addressing different stages of technological maturity:

1. **Innovation Support**: Focused on testing and validating Industry 4.0 solutions at **Technology Readiness Levels (TRL) 4-7**.
2. **Go-to-Market Support**: Aimed at demonstrating and scaling innovative solutions at **TRL 8-9**.

Who Was Eligible for the Open Calls? Proposals for manufacturing SME digitalization projects were submitted either **individually** by a technology provider SME or in **partnership** by two technology provider SMEs, including at least **one industry partner** for complex solutions. **Cross-border partnerships** were strongly encouraged to enhance collaboration. Applicants, including technology suppliers and industry partners, had to be registered in an **EU27 Member State** or a **Horizon 2020 Associated Country**.

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Eligibility required alignment with specific **NACE codes**:

- **ICT Service Providers** working on Industry 4.0 solutions under **NACE Codes J620** (software development) or **J631** (data hosting and processing).
- **Technology Providers** producing machinery, tools, or robots for manufacturing industries under **NACE Codes C26, C27, C28, or C33**.

The industry end-user (SME or large enterprise) needed to represent a **manufacturing use case** classified under **NACE Category C**, with a focus on sectors like metal, mechanics, automotive, and mechatronics. Eligibility also extended to other manufacturing sectors, such as **agri-food** or **textile**, requiring technological upgrades.

B. FACILITATING INNOVATION THROUGH DIRECT SUPPORT

MIND4MACHINES provided direct financial support to SMEs and startups, enabling them to prototype, test and scale up their innovative solutions. With a total funding pool of €3.3 million, two open calls were launched to address specific needs, including:

- Prototyping and Testing: Developing functional models of new solutions.
- Demonstration and Piloting: Showcasing innovations in real-world manufacturing environments.
- Large-Scale Product Validation: Ensuring market readiness.
- Market Replication: Expanding solutions to multiple industrial contexts.

Between 55 and 165 SMEs/entrepreneurs directly benefited from these initiatives, bringing transformative ideas to life and advancing industry innovation. The project focused on integrating key technologies to drive digital transformation, such as:

- Cloud Computing for scalable IT infrastructure.
- Big Data to extract insights from complex datasets.
- IoT to connect devices and streamline processes.
- Cybersecurity to protect systems and ensure operational integrity.
- Artificial Intelligence for process optimization through machine learning and expert systems.
- Process Control Systems to enable advanced automation and precision.

C. INNOVATIVE PROJECTS

This document presents three innovative projects, funded by MIND4MACHINES through direct financial and innovation services support via open calls, that exemplify the successful integration of Industry 4.0 solutions and sustainable manufacturing principles within diverse industrial settings. These projects showcase how cutting-edge technologies, such as the Internet of Things (IoT), data analytics and cloud computing have been used to improve production processes, enhance resource utilization and minimize waste. Furthermore, they highlight the role of digitalization in enabling real-time monitoring, data-driven decision-making and the implementation of effective strategies to reduce carbon footprints and promote environmental sustainability.

C.1 IPES Project

Tech Focus: Industry 4.0, Manufacturing Automation, Digital Transformation

The **IPES** project, led by KFactory and MUSA-PITESTI'96 SRL, aimed to digitize manufacturing processes and increase efficiency. The project implemented the **KFactory Platform**, an Industry 4.0 solution for real-time data collection and analysis of production metrics, energy consumption, and CO_2 emissions. Key innovations included:

- **Automated Data Acquisition**: Real-time monitoring of industrial machines to track KPIs like OEE (Overall Equipment Efficiency) and energy efficiency.
- **Advanced Business Intelligence**: Insights and optimization tools for decision-makers.
- **Sustainability Features**: Energy consumption and CO_2 footprint calculations.

Impact: IPES achieved a **10% increase in OEE** and reduced manual data collection efforts by **97%**, demonstrating measurable improvements in production efficiency and sustainability. The platform is now ready for deployment to other manufacturing companies.

C.2 TEXTRACK Project

Tech Focus: IoT, Smart Logistics, Data Analytics for Textile Manufacturing

The **TEXTRACK** project, led by Amper S&C IoT, Eliar Elektronik and Mayteks, introduced an **indoor location tracking system** for textile manufacturing. Using Wi-Fi infrastructure and data analytics, the project optimized fabric movement tracking within facilities. Key innovations included:

- **Indoor Location Tracking**: Accurate tracking of fabric-trolleys with sub-10-meter precision.

- **Mobile and Analytics Integration**: Location data processed via advanced analytics to identify inefficiencies and bottlenecks.

Impact: Deployed at Mayteks, the project reduced fabric search time by **95%** and achieved **TRL7** (pilot readiness), demonstrating significant improvements in logistics and process efficiency.

C.3 AIWMS Project

Tech Focus: Artificial Intelligence, Warehouse Management, Supply Chain Optimization

The **AIWMS** project, focused on warehouse operations, integrated an **AI algorithm** to optimize order-picking processes. The solution, developed as part of the PinQuark warehouse management system, featured:

- **Real-Time Route Optimization**: Dynamic recalculation of optimal worker paths to minimize time and increase efficiency.
- **Buffer System**: Storage of pre-calculated routes for faster recalculations.
- **User-Friendly Interface**: Ensuring easy adoption by warehouse staff.

Impact: The project reached **TRL8**, demonstrating successful integration and testing in real-world warehouse settings. It significantly improved order-picking efficiency and is now ready for full deployment.

D. EUROPEAN INNOVATION COUNCIL (EIC) ACCELERATOR

The **European Innovation Council (EIC)**, established under the Horizon Europe framework, is a EU tool that can be used to promote innovation and entrepreneurship. With its flagship **EIC Accelerator** program, the EIC is offering funding and support to high-potential startups and small and medium enterprises (SMEs). At its core, the EIC aims to bridge the gap between innovative ideas and market success. By identifying and supporting innovations with transformative potential, the council seeks to position Europe as a global leader in technology and entrepreneurship. The EIC focuses on innovations that challenge traditional market norms, providing resources to scale disruptive technologies and business models across various sectors, including health, energy and digital transformation.

EIC Opportunities for M4M Projects - MIND4MACHINES financed projects from both Open Calls can use the aid offered by the EIC Accelerator to secure additional funding, validate early-stage solutions and scale innovations to global markets. By connecting innovators with investors and mentors, the EIC enhances the market readiness of projects, ensuring they achieve widespread adoption and long-term sustainability.

The EIC Accelerator: Empowering High-Risk, High-Gain Innovations - The EIC Accelerator program is tailored to support SMEs and startups that are developing high-risk, high-impact innovations. Designed to bridge the funding gap faced by many early-stage enterprises, the program offers a unique blend of financial and non-financial support:

- **Financial Support**: The EIC Accelerator provides grants of up to **€2.5 million** for innovation activities, along with equity investments of up to **€15 million** through the EIC Fund.
- **Tailored Mentorship**: Beneficiaries gain access to expert mentors and business coaches who help refine business strategies, enhance technical capabilities and prepare for market entry.
- **Access to Networks**: The program connects participants with a vast network of investors, industry leaders, and policymakers, facilitating partnerships and scaling opportunities.
- **Support for Market Deployment**: Beyond R&D, the EIC Accelerator helps innovators navigate the complexities of commercialization, ensuring their solutions achieve market traction.

Opportunities for Innovators and Entrepreneurs - The EIC Accelerator presents numerous opportunities for European SMEs and startups (including both Open Calls):

- **Early-Stage Validation**: Through grants, the program enables innovators to validate their concepts and refine their prototypes.
- **Scalability**: By providing equity funding and connecting beneficiaries with investors, the EIC supports companies in scaling their solutions to global markets.
- **Recognition and Credibility**: Securing EIC funding enhances a company's credibility, attracting additional investments and partnerships.
- **Cross-Sector Collaboration**: The EIC improve collaboration across industries, enabling interdisciplinary solutions to complex challenges.

For MIND4MACHINES-financed projects, the EIC serves as a natural next step to advance innovations developed during the Open Calls. **Projects can make use of the EIC's resources to further validate, commercialize and scale their technologies beyond regional boundaries, ensuring greater impact and adoption.**

E. GOOD PRACTICES IN IMPLEMENTING STATE-OF-THE-ART ICT SOLUTIONS WITHIN MIND4MACHINES

The **MIND4MACHINES** project successfully promoted innovation and digital transformation by providing direct support to SMEs through financial aid, accelerator services and matchmaking opportunities. This approach enabled the testing, validation and scaling of advanced digital solutions in real-world manufacturing environments, leading the European manufacturing sector toward smarter and greener operations.

E.1 THE MIND4MACHINES PLATFORM: A CENTRALIZED DIGITAL HUB

At the heart of MIND4MACHINES lies its **website application tool**, a demonstrative platform that integrated multiple project services. Designed to foster collaboration and innovation, the platform served as:

- An **Open Innovation Space** where manufacturing SMEs and ICT solution providers exchanged ideas to solve real-world challenges.
- A **Virtual Meeting Point** for B2B matchmaking, facilitating cross-sectoral partnerships and collaborations.
- A **Gateway for Open Calls**, offering access to rules, templates, online applications, and project submission tools.
- A repository for tools such as the **Investment Readiness Level (IRL) Self-Assessment**, helping SMEs evaluate their preparedness and define actionable roadmaps for scaling innovations.

This platform was not only maintained throughout the project but was designed for long-term usability, ensuring its value extends beyond MIND4MACHINES' completion.

E.2 SUPPORTING OPEN CALLS AND COLLABORATION

The platform had a strong impact in the project, as it was a support in managing the project's two **Open Calls** (OC1 and OC2), offering streamlined submission, evaluation and reporting processes. It provided a dynamic space where SMEs could submit deliverables, interact with consortium partners, and register for key project events. Furthermore, the **Virtual Meeting Point**—built on the proven **F6S platform**—acted as a marketplace for idea exchange. Manufacturing companies were able to publish their **technological and development needs**, which were addressed by ICT SMEs and startups. This open collaboration space facilitated the formation of partnerships and project proposals submitted to the Open Calls, encouraging cross-border innovation.

E.3 ACCELERATOR PROGRAMS AND E-LEARNING TOOLS

To strengthen SME capacity, the platform hosted **MIND4MACHINES Accelerator** tools, including an **e-learning module**. Built on the existing infrastructure of ICI, the tool provided online courses and training resources, enabling SME clusters, coaches, and industry experts to deliver tailored support to startups and SMEs. This ensured participants improved their **innovation readiness**, strengthened investor appeal, and enhanced their decision-making processes. The beta version of the platform underwent a **small-scale validation pilot**, where select SMEs tested the tools and provided feedback for refinement. This iterative approach ensured the platform's readiness for widespread deployment.

E.4 CONCLUSION: A UNIFIED DIGITAL ECOSYSTEM FOR INNOVATION

The **MIND4MACHINES platform** exemplified best practices in supporting ICT-driven innovation. By combining open innovation spaces, matchmaking tools, accelerator programs and open call management systems, it became a comprehensive digital ecosystem for collaboration and growth.

F. CONCLUSION

The **MIND4MACHINES (M4M)** project has successfully demonstrated how targeted support, advanced digital tools and collaborative ecosystems can play a relevant role into European manufacturing sector transformation. By integrating smart technologies such as **IoT, Artificial Intelligence, Big Data, Cloud Computing, Cybersecurity** and **Advanced Automation Systems**, M4M helped financed SMEs to innovate, optimize their operations and improve their sustainability.

Through **two Open Calls** and direct financial aid, M4M enabled SMEs to **prototype, test, validate** and **scale** their solutions, addressing real-world manufacturing challenges and advancing their market readiness. Additionally, the **MIND4MACHINES platform**, acting as a centralized digital hub, built a strong collaboration tool between manufacturing and ICT sectors through using **Virtual Meeting Point**, open innovation spaces and e-learning accelerators. These elements ensured ideas exchange, matchmaking for partnerships and capacity building for SMEs. The successful implementation of projects like **IPES**, **TEXTRACK** and **AIWMS** highlights the transformative power of Industry 4.0 solutions in enhancing efficiency, productivity and sustainability. These initiatives provide tangible proof that digital innovation, when supported strategically can modernize manufacturing processes, reduce environmental footprints and strengthen European competitiveness. As a result, M4M not only delivered on its mission to promote innovation but also set the foundation for a **sustainable, cross-sectoral ecosystem** that will continue to resist beyond the project's duration. Projects funded under M4M can now make use of smart tools like the **European Innovation Council (EIC) Accelerator** to scale their solutions globally, ensuring a lasting impact on Europe's industrial future.

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