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RECENTRE

D.1.1.1 - REPORT ON SME'S NEEDS AND EXPECTATIONS FOR THEIR GREEN TRANSFORMATION

Lead Beneficiary: Technology Park Ljubljana

Main Author: Matej Kirn, Aleš Pevc

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RECENTRE

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DOCUMENT SHEET

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ABBREVIATIONS

Abbreviation	Definition
SME	Small and Medium-sized Enterprise
AT	Advanced Technology / Technologies
AI	Artificial Intelligence
IoT	Internet of things
LCA	Life Cycle Assessment
ERC	Enterprise Resource Planning
CRM	Customer Relationship Management
ESG	Environmental, Social, and Governance
GDPR	General Data Protection Regulation
KPI	Key Performance Indicator
WP	Work Package
PU	Public (dissemination level)
LP/PP	Lead partner/project partner
ASP	Alpine Space Programme
ROI	Return on Invesment
HMI	Human Machine Interface

EXECUTIVE SUMMARY

The Alpine manufacturing sector is at a critical juncture, facing the need to adapt to green, digital, and human-centric transformations. At the center of this shift is **RECENTRE (ASP0500348)**, a strategic umbrella initiative designed to drive this transition. Far from a generic approach, **RECENTRE focuses on three core sectors that define the Alpine industrial landscape: bioeconomy, automotive, and mechatronics.**

Built on a SME-centered methodology, RECENTRE applies the Industry 5.0 framework through three interconnected pillars: **digital**, **green transition and human centric transition.** Tailored actions and pilots directly target SMEs in the project's key sectors.

This focused approach enables RECENTRE to develop adaptable transition pathways, test support systems, and produce policy-relevant outcomes that reflect real industrial needs, positioning the project as the central platform for systemic change in Alpine manufacturing.

Deliverable 1.1. presents the findings of Activities 1.1 within work package 1, which examined SME needs and expectations for their triple transition across the Alpine region through a cross-regional questionnaire, three transnational webinars (on AI, green transition, and workforce skills), and 16 local workshops involving CEOs and employees from mechatronics, bioeconomy, and automotive sectors.

Across all **priority areas**—green, digital, and human-centric—SMEs reported recurring challenges: high financial barriers, limited technical capacity in eco-design, LCA, AI, and reporting, low digital maturity—especially in micro and traditional firms, regulatory complexity, skill shortages, and resistance to change, particularly among older workers. Despite these obstacles, SMEs expressed strong readiness to transform, if support systems are modular, practical, and tailored to their specific needs.

They emphasize the importance of accessible financing (e.g. vouchers, innovation checks), real-world testing opportunities before investment, hands-on toolkits, sector-specific training via local innovation hubs, and peer-learning and mentoring. Equally important is the inclusion of employees in shaping change processes.

1. INTRODUCTION AND OBJECTIVES

The Alpine manufacturing sector is undergoing a profound transformation, shaped by the accelerating pace of digitalization, growing environmental imperatives, and social changes (such as aging of the EU population,). As global supply chains continue to experience volatility, and climate regulations become increasingly stringent, small and medium-sized enterprises (SMEs) the backbone of the Alpine region's industrial landscape—face a growing urgency to adapt. This transformation is no longer optional; it is essential for survival, resilience, and competitiveness.

The RECENTRE project (ASP0500348), co-founded by the Interreg Alpine Space Programme, was launched to guide and support SMEs in this process of adaptation by addressing the three core dimensions of transition. These pillars are directly embedded in the European Commission's Industry 5.0 strategy,[1] which positions industry not only as a driver of growth and competitiveness, but also as a provider of sustainable, resilient, and human-centred solutions for society. By aligning this vision, RECENTRE ensures that Alpine SMEs are prepared to embrace a future where technology, sustainability, and people are integrated as mutually reinforcing drivers of industrial transformation- together known as the triple transition:

- **Digital transition:** RECENTRE supports SMEs in adopting cutting-edge technologies—including artificial intelligence, digital twins, IoT, robotics, and automation—as key enablers of smarter, more adaptive manufacturing systems.
- **Green transition:** Supporting the shift toward low-carbon, resource-efficient, and circular business models, helping SMEs align with EU climate goals and societal demand for sustainability.
- **Human-centric transition:** Rooted in the principles of Industry 5.0, this transition places people and society at the heart of innovation, ensuring that technology serves human needs, protects workers well-being, and fosters inclusive, meaningful work environments.

2. DATA SOURCES AND METHODOLOGY

The project began by actively involving SMEs in shaping a practical, demand-driven transformation model aligned with Industry 5.0 principles. Early activities focused on assessing the readiness, barriers, and specific needs of up to 450 manufacturing SMEs, with particular attention to the mechatronics, automotive, and bioeconomy sectors. Beyond data collection, the process aimed to raise awareness, stimulate peer learning, and strengthen strategic alignment—ensuring that the transition toward green, advanced, and human-centric manufacturing is both grounded and tailored to SME capabilities. To achieve this RECENTRE implemented three key instruments:

[1] Industry 5.0 - European Commission

- **Online assessment survey**

To map SME capacities and gaps across the digital, green, and human-centric pillars of Industry 5.0, RECENTRE deployed a multilingual online survey in all partner regions. The questionnaire covered six areas—Industry 5.0 readiness, green transition (environmental and human aspects), financial capacity (feeding WP1.3), and concrete next steps—so that results provide both a baseline and a roadmap for tailored support.

In total, **66** responses were received; after filtering to the target sectors (automotive, mechatronics, bioeconomy), **54** valid questionnaires remained **("From the English-language survey, 17 responses were collected; from the French-language survey, 23; from the German-language survey, 8; and from the Italian-language survey, 5.").** Engagement was broad but modest, confirming that Industry 5.0 and the triple transition are still at an early stage for many SMEs. Respondents were mainly small and medium-sized firms, in line with RECENTRE's focus.

Overall familiarity with **Industry 5.0 was moderate (3/5). AI and Big Data show the highest current uptake (~3/5), while IoT, XR, edge computing, and cybersecurity remain limited (~1–2/5).** As one German participant remarked: **"Without specific training in AI, IoT, and robotics, we cannot start the transformation**." The principal barriers are high implementation costs and uncertain ROI, lack of in-house expertise, and concerns about data privacy and security.

On the green side, many firms report progress on **renewables and waste reduction, but adoption of eco-design, LCA, PLM, and water measures is still low**. An Italian participant pointed out: "Green and digital solutions are still too expensive and difficult to access." Human-centric efforts focus primarily on health and safety, with low penetration of collaborative robots and other advanced workplace technologies.

Financial constraints amplify these gaps: awareness of funding options is uneven, and application procedures are seen as complex. A French SME summarized the situation: "Without easier access to finance, our transformation will stay on paper."

Looking ahead, SMEs clearly request **short, hands-on, sector-specific training and simplified, transparent financing to support investment in Industry 5.0 and green solutions**. As one workshop participant put it: "Seeing technology in action makes it easier to trust and invest."

These priorities directly inform the **RECENTRE methodology and the design of pilot actions,** ensuring that support responds to SMEs' concrete needs and expectations. Given the lower-than-expected response rate to the survey (53 SMEs), compared to the overall target of reaching approximately 450 SMEs across all activities (survey, webinars, and workshops), the survey results will not carry the same analytical weight as originally intended. "They will therefore be treated with reduced weight in the final synthesis, contributing approximately 15% to the total evidence base. This percentage is derived from the overall outreach: out of 368 SME companies addressed, only 53 provided responses to the assessment survey, which represents around 15% of the total input collected.

The interpretation of SME needs, barriers, and expectations will therefore rely primarily on the results obtained from local workshops (46%; 171 participants of 368) and webinars (39%; 143 participants of 369 in total)which engaged a broader and more diverse set of stakeholders — including both company leadership and employees — across partner regions.

This adjusted weighting ensures that the analysis remains methodologically sound and reflective of the broader innovative ecosystem, despite the limited participation in the survey itself.

- **A series of three transnational webinars, each exploring a pillar of the triple transition—advanced technologies, workforce upskilling, and sustainability.**

To complement the survey, the RECENTRE consortium organized **three transnational webinars** to raise SME awareness and gather inputs on the triple transition—AI and advanced technologies, workforce skills, and the green transformation. In total, **289** participants took part, including **143** SMEs (68 in the AI session, 10 in the skills session, 42 in the green session). The distribution reflects differing levels of familiarity: technology remains the most recognized pillar, while human-centric is the least because companies do not have the human centric innovation on their agenda as much as other topics.

- **AI & Industry 5.0 (27 November 2024, TP Ljubljana, 131 participants, 68 SMEs)**

This webinar introduced AI as both a driver of competitiveness and a human-centric enabler. Presentations highlighted practical use cases in **predictive maintenance, energy optimisation, and digital twins. Dr. Bertalanič stressed**: "AI should not be treated as a black box. We build knowledge-based digital twins that integrate domain expertise with real-time sensor data. His examples showed how digital twins can interact with operators through natural language and voice, improving usability and trust. Dr. Usländer, by contrast, warned that much of Industry 5.0's societal promise had already been foreseen in Industry 4.0 but remained unfulfilled: "The societal benefit was already part of Industry 4.0's vision—it's not new. What we need now is implementation, not just terminology." He presented the **PAISE® model** and the **FA³ST platform**, underlining the need for regulated, explainable AI ecosystems that protect data sovereignty—critical for SMEs.

Feedback was highly positive**: 61.5% rated speakers 5/5**, praising the diversity of expertise, concrete examples, and opportunities for direct exchange. The session confirmed strong SME interest in AI when presented in accessible, application-focused ways.

- **Worker Skills in Industry 5.0 (12 December 2024, TP Ljubljana, 55 participants, 10 SMEs)**

This session examined how workforce competence must evolve alongside technological change. Chiara Remundos (t2i) framed competence as "the demonstrated ability to apply knowledge, skills, and attitudes to achieve specific outcomes." Ines Gergorić emphasised hybrid profiles: "The future of work belongs to those who can combine technical expertise with human creativity and emotional intelligence." Michel Klingler (PROEVOLUTION) stressed the psychological side of transformation: "Focus the energy of your team on what you can control or influence," highlighting the importance

of trust-building and communication. SME feedback reinforced these insights: **60% rated speakers 5/5**, and participants welcomed the mix of challenges and concrete solutions. One noted: "The webinar summed up all the challenges and gave concrete solutions on how to address them." Another called for a shared repository of use cases to support peer learning. The event underlined that while technologies advance rapidly, **human adaptation and support remain** the decisive factor in successful transitions.

- **Green Transition in Industry 5.0 (22 January 2025, online, 90 participants, 42 SMEs)**

This webinar showcased how Industry 5.0 can embed sustainability into core business practices. Johanna Kargruber (EDU-CIRC) stressed: "Sustainability must become an integral part of the corporate mindset," pointing to small but systematic measures such as automated energy management and green sourcing. She highlighted **industrial symbiosis**, e.g. shared water systems and bilateral energy exchanges, as key innovations. Xavier Battinger (Ricoh Industrie France) presented Ricoh's GreenLine™ remanufacturing program, where "up to 94.4% of parts by weight are reused," demonstrating how circularity can align environmental and economic goals. He argued that predictive data intelligence is essential to scale these models. Participants concluded that Industry 5.0's promise lies not only in advanced technologies, but in systems and mindsets that integrate sustainability **from design to lifecycle**, delivering both competitiveness and environmental resilience.

- **A cycle of 16 local workshops**

To complement survey and webinar input, RECENTRE partners organized **16 local workshops** (one CEO-focused and one employee-focused in each partner region). In total**, [insert total participants]** individuals took part, including around **171 SMEs**. This ensured both leadership and workforce perspectives were captured in parallel. Anchored in the Industry 5.0 framework, the workshops aimed to support the **triple transformation of Alpine SMEs** while keeping people at the centre. CEO sessions provided strategic dialogue on technology adoption, financing, and sustainability alignment, while employee sessions focused on operational changes, skills need, and workplace trust.

The local workshops were organised as a **structured cycle of events** between February and June 2025, with each partner hosting one workshop for CEOs and one for employees. This dual approach ensured that both **strategic leadership perspectives** and **operational workforce insights** were systematically captured.

The local workshops were designed and implemented as in-person events combining presentations, expert discussions, interactive sessions, and hands-on activities. Each partner organized two workshops, one targeting company leadership (CEOs, founders, innovation managers) and one aimed at employees (technical and non-technical staff, including HR, production, and operations teams). This ensured both strategic and operational perspectives were collected in parallel. The workshops took place between February and June 2025 and were hosted

by project partners in their respective regions. It was organized by T2I, Trentino Svilupo, Technology Park Ljubljana, Bayern Innovative, Stenbeis 2i, CCI Alsace, Creating Integrated Mechanical Systems Auvergne Rhone-Alpes Systems and Business Upper Austria OÖ Wirtschaftsagentur GmbH.

Organizers tailored the format to their local innovation ecosystems, often combining structured keynotes and roundtables with participatory formats such as design thinking exercises, canvas-based group work, and live technology demonstrations. Most sessions included thematic inputs on Industry 5.0, AI adoption, digital and green transitions, and workforce resilience. Additional activities included visits to innovation centers, discussions on public funding instruments, and SME presentations of ongoing transformation efforts. Through these varied formats, the workshops facilitated peer learning, captured barriers and opportunities, and collected recommendations to guide future RECENTRE activities.

Across Alpine Space, RECENTRE partners organised participatory workshops to capture SME barriers, needs, and expectations. In Italy, **Trentino Sviluppo** applied canvases and design thinking, revealing issues such as limited data use, weak people strategies, digital illiteracy, and leadership resistance. **T2i** workshops combined expectation-mapping and teamwork, where CEOs raised concerns about ROI uncertainty, mistrust in AI, and limited access to infrastructures, while employees stressed the need for training, user-friendly tools, and clearer communication. In Germany, **Steinbeis 2i** focused on employees, exposing fears of job loss, skills gaps, and reliance on subsidies, alongside strong calls for transparent communication, continuous training, and greater involvement in decision-making. In Austria, **Business Upper Austria** used panel debates and participatory exchanges, which highlighted systemic barriers such as rigid education systems, bureaucratic funding procedures, and low digital skills, while pointing to talent attraction, simpler funding, and knowledge sharing as key priorities. In France, **Auvergne-Rhône-Alpes** workshops relied on group discussions that underlined difficulties in applying Industry 5.0 and expressed clear expectations for guidance, peer learning, and tailored support. Finally, in **Slovenia**, group work and open discussions revealed low awareness of Industry 5.0, limited managerial capacity, and workforce skills gaps, together with expectations for more support services, practical training, and stronger trust between employers and employees.

All results from these activities were consolidated through a **SWOT analysis.** "To better understand the internal and external factors influencing the project, a SWOT analysis was conducted. A SWOT analysis is a strategic planning tool that assesses four key dimensions: strengths, weaknesses, opportunities, and threats. Strengths and weaknesses capture internal aspects such as resources, expertise, or organizational gaps, while opportunities and threats focus on external elements such as market trends, policy developments, or competitive pressures. By systematically combining these perspectives, the SWOT framework provides a balanced overview of where the project can build on existing advantages, address internal limitations, seize emerging opportunities, and anticipate potential risks." Barriers and challenges were categorised as weaknesses and threats, while needs and expectations were captured as strengths and opportunities. This structured approach ensured that diverse inputs from CEOs and employees were aligned within a common

framework, enabling robust cross-regional comparison. Building on this categorisation, the results were aggregated and counted, so that qualitative insights could be complemented with quantitative evidence. The SWOT analysis therefore acted as both a synthesis and an evaluation tool, providing a coherent picture of the barriers, needs, and expectations shaping SME transformation across the Alpine region.

- **CEO perspectives**

Discussions emphasised leadership vision, financing challenges, and the cultural shifts required for transformation. Italian CEOs stressed human–machine collaboration: "AI should be seen as a co-pilot, not a spy." Slovene leaders urged proactivity: "We need to move from reacting to driving change—waiting for perfect conditions means falling behind." Austrian CEOs highlighted adaptability: "Resilience is built when trust, skills, and flexibility go hand in hand."

Across countries, recurring barriers included **high investment costs, legacy system integration, skills shortages, and regulatory complexity.** German CEOs described a "culture of waiting" for public funding. Despite this, opportunities were clear: **innovation acceleration, product traceability, energy efficiency, and talent attraction through purpose-driven strategies.**

- **Employee perspectives**

Employee workshops highlighted operational realities and workforce concerns. Live demonstrations of robotics, energy dashboards, and human–machine interfaces helped contextualize discussions. A German worker voiced a common concern: "Our fear is not the technology itself but being left out of the process." French employees linked transformation to recruitment: "Industrial jobs will attract young people if we connect them to purpose." Italians pointed to information gaps: "We can't apply for opportunities we don't know exist."

Trust emerged as the decisive factor: employees called **for short, targeted training, mentoring systems, and co-design opportunities.** They linked adoption success to **better communication, clear career pathways, and visible workplace improvements.**

Cross-country insights

- Italy: Bridging cultural and technological change through AI and human–machine interaction.
- Slovenia: Strong focus on leadership vision and partnerships.
- Germany: Recognised SME agility but cautioned against slow decision-making.
- France: Emphasised early employee involvement and pilot projects as trust-building tools.
- Austria: Underlined foresight, adaptability, and embedding trust in workplace culture.

Shared barriers included skills shortages, legacy system rigidity, regulatory delays, and low awareness of funding. **Shared opportunities** included parallel green–digital upgrades, SME flexibility, EU/regional funding, and embedding sustainability KPIs.

Best practices consistently pointed to:

- Early and continuous employee involvement.
- Low-risk proof-of-concept pilots.
- Cross-functional innovation teams.
- Short, targeted training cycles.
- Public recognition of early successes to build momentum.

Together, the workshops provide **empirical evidence and strategic direction.** They capture not only statistics, but also the lived experiences of Alpine SMEs. Their insights will directly inform RECENTRE's **pilot actions, transformation, methodology, and transnational support strategy** under Industry 5.0.

Activity	Number of addressed companies	Percentage	Addressed companies goal from proposal
	Total number 368		
Assesment survey	54	15%	450
Webinars	143	39%	
Local workshops	171	46%	

Table 1: Shares of addressed companies per activity, own source

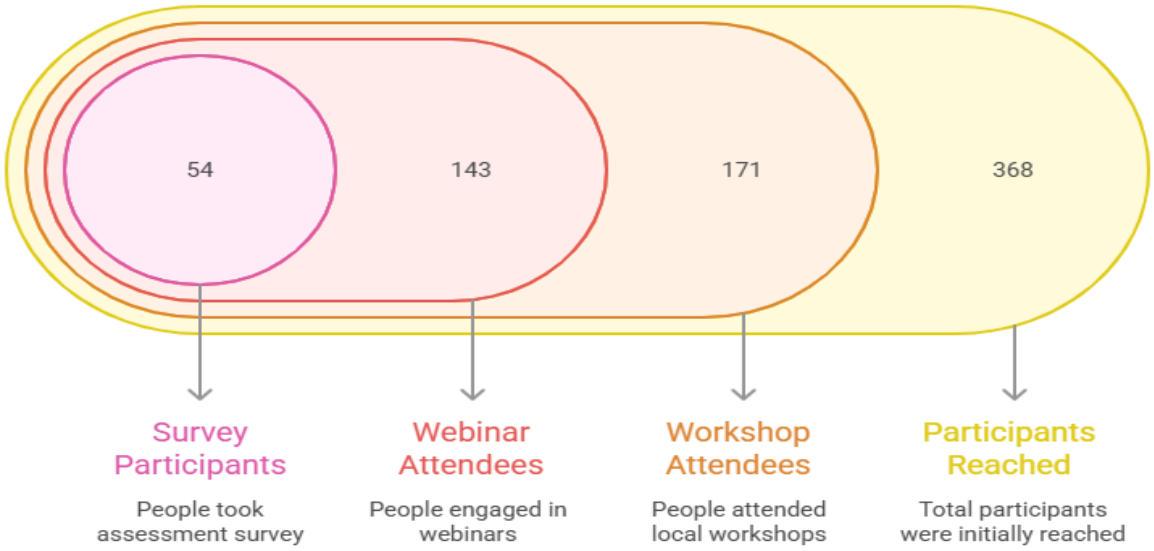

Figure 1: Sum of adressed SME companies in WP 1, own source

3. METHODOLOGY TO ASSESS NEEDS AND EXPECTATIONS BY SMEs

To assess the needs and expectations of Alpine manufacturing SMEs, RECENTRE applied a structured methodology combining quantitative and qualitative methods. Data from surveys, thematic webinars, and local workshops captured both strategic insights from CEOs and operational perspectives from employees across the three Industry 5.0 pillars: Green Transition, AI & Digitalization, and Worker Skills. Frequency analysis and multi-source verification ensured that results were comparable across regions and robust enough to inform targeted support measures. All findings from the assessment survey were compiled in structured Excel sheets, while the results from webinars and local workshops were gathered using pre-prepared reporting templates. The most important component within these templates was the SWOT analysis matrix, which served as the key tool for capturing strengths, weaknesses, opportunities, and threats as perceived by SMEs. By systematically comparing opportunities and strengths with identified needs and barriers, the SWOT analysis enabled the extraction of clear and actionable expectations, transforming challenges into targeted demands for support, and opportunities into concrete implementation priorities.

2.1 DATA COLLECTING

The RECENTRE project used a mixed-methods approach to gain valid, reliable, and representative insights into the readiness and transformation needs of Alpine manufacturing SMEs. Data came from three main sources:

- **Assessment Survey** – A structured, multi-language questionnaire designed with project partners to measure SMEs' Industry 5.0 readiness, technology adoption, barriers, and support expectations. It combined quantitative items (Likert scales, multiple-choice) with qualitative items (open-ended responses), was piloted for clarity, distributed via SME networks, and anonymized in line with GDPR.

- **Thematic Webinars** – Three online events that both shared knowledge and gathered input, each on a core theme:
  - AI & Industry 5.0 – adoption, integration, and ethics
  - Green Transition in Industry 5.0 – energy efficiency, sustainable models, circular economy
  - Worker Skills in Industry 5.0 – upskilling, reskilling, human-centered innovation

Each combined expert presentations with interactive polls, Q&A, and live discussions. Feedback was coded thematically to inform workshop design.

- **Local Workshops** – Sixteen facilitated sessions (one CEO-focused, one employee-focused per partner region) functioning as focus groups. CEO sessions covered strategy, investment, and green–digital integration; employee sessions addressed operational changes, workplace adaptation, and skills needs. Standardized templates, facilitator notes, and polls ensured cross-country comparability.

The integration of survey results, webinar feedback, and workshop discussions enabled triangulation, increasing both the validity and the generalizability of findings.

2. 2 DATA ANALYSIS

Analysis focused on identifying the most frequent topics, barriers, opportunities, and best practices across all three sources. Data were standardized for comparability. Survey responses were coded numerically to calculate frequencies and percentages, while qualitative data from surveys, webinars, and workshops underwent thematic coding to group similar ideas. Each theme was then counted across:

- Survey responses
- The three webinars (Green Transition, Worker Skills, AI & Industry 5.0)
- The sixteen workshops (CEOs and employees analyzed separately)

Counts were used to create tables and rankings, highlighting both common priorities and regional differences. Coding was reviewed by multiple team members to ensure consistency, and multi-source verification strengthened the reliability of the conclusions.

4. FINDINGS

The findings are presented in two categories — **Needs and Expectations** — as many identified issues span multiple aspects of Industry 5.0, including green transition, AI & digitalisation, and human-centred innovation. Each category is detailed through inputs from the Assessment Survey, Thematic Webinars, and Local Workshops, combining quantitative data with qualitative insights and direct quotes from SMEs and field experts. This structure ensures a clear, multi-source view of the priorities and challenges faced by Alpine manufacturing SMEs.

3.1 NEEDS OF SMEs

The needs of Alpine SMEs reflect the essential preconditions for advancing towards sustainable, digital, and human-centred Industry 5.0 practices. They span technology adoption, workforce skills, financial and organisational support, and change management. Inputs from the survey, webinars, and local workshops highlight recurring demands across regions, sectors, and company sizes.

3.1.1 INPUTS FROM ASSESSMENT SURVEY

The RECENTRE SME survey (France, Germany, Italy, Slovenia) shows broad alignment across the Alpine Space. Despite differences in maturity, SMEs share a strong ambition to deploy **AI, IoT, robotics, and digital twins** in ways that improve both productivity and working conditions.

- **Technological priorities**: AI and Big Data are most frequently cited (process optimization, predictive maintenance, decision-making), followed by IoT (real-time monitoring), and robotics (efficiency, safety). Sector-specific interests include blockchain for carbon credits (bioeconomy), machine vision (precision manufacturing), and robotics–IoT integration (mechatronics).
- **Barriers**: High costs and uncertain ROI are universal concerns, compounded by **skills shortages, integration challenges, and data/cybersecurity risks**. Green adoption is further slowed by limited access to affordable eco-technologies and unclear business cases.
- **Financial gaps**: SMEs cite **low awareness of funding**, complex procedures, and perceived ineligibility. Those applying rely mainly on grants and loans. Clear requests emerge for **tax incentives, tailored ROI guidance, and public–private investment partnerships**.
- **Skills demand**: Training is highlighted as the **single most important enabler**, with SMEs asking for **short, practical, sector-specific learning opportunities** (AI, IoT, robotics, CAD, cybersecurity, eco-design, LCA). Peer learning—through company visits and live demonstrations—is valued to "make technology real."

As one Italian CEO put it: *"We need training that is concrete, short, and directly applicable to our work."* A German participant added: *"Without specific training in AI, IoT, and robotics, we cannot start the transformation.*

3.1.2 INPUTS FROM WEBINARS

The three RECENTRE webinars confirmed that SMEs expect technologies to **improve both productivity and job quality**.

- **AI & Industry 5.0**: Demand for affordable, interoperable solutions that integrate smoothly into existing systems. SMEs stressed the need for secure, sector-specific data spaces and real-world demonstrations. *"We need to see these tools applied in settings like ours, so workers can understand their value and feel confident using them."*
- **Workers' Skills**: SMEs called for training that **combines technical and soft skills**, alongside strong leadership engagement. One CEO noted: *"If employees understand why the change is happening and how it benefits them, they will embrace the technology."*
- **Green Transition**: Firms expressed interest in **AI-enabled energy monitoring, predictive maintenance, and circular economy models**. Yet costs and bureaucracy remain significant barriers. A Slovenian SME summarised: *"The technology is there, but the costs, bureaucracy, and uncertainty make it hard for smaller companies to use it."*

Across all webinars, SMEs emphasised five main needs: seamless workflow integration, hands-on training, enhanced safety and ergonomics, transparent regulation, and proven, real-world examples.

3.1.3 LOCAL WORKSHOPS INPUT

Workshops in Italy, Slovenia, Germany, Austria, and France provided ground-level insights.

- **Integration and gradual adoption** were critical: *"We cannot afford to stop production to change everything at once—solutions must integrate with what we have"* (Italy, CEO). Austrian employees added: *"We collect a lot of data, but don't know how to use it effectively."*
- **Workforce adaptation**: German CEOs stressed skills: *"Technology adoption is only possible if people have the right skills."* French leaders emphasised leadership style: *"Leaders must explain the why, not only the how, if they expect employees to embrace change."*
- **Sustainability barriers**: Italian employees noted: *"Green and digital solutions are still too expensive and difficult to access."* Austrian CEOs highlighted incremental benefits: *"Small improvements in process efficiency can yield significant results if applied systematically."*
- **Common barriers**: High costs, unclear ROI, limited internal capacity, fragmented funding, and lack of expertise.
- **Opportunities**: Partnerships with providers, peer-to-peer exchanges, simplified funding, and pilot projects to prove both productivity and workplace benefits.

A French employee summarised: *"Show us, don't just tell us—real examples make the difference."*

3.1.4 INTEGRATED NEEDS FROM SMES IN ALPINE REGION

Across survey, webinar, and workshop inputs, four priority needs emerged:

1. **Training in Industry 5.0 technologies** (36 mentions)

Training in Industry 5.0 technologies is the most pressing need, aimed at equipping workers with practical, immediately applicable skills to operate and manage new systems effectively. SMEs request short, hands-on, sector-specific programmes covering AI for predictive maintenance and process optimisation, IoT for real-time production monitoring, collaborative robotics for safe and efficient human–machine interaction, CAD and digital twin modelling for design-to-production integration, data analytics for operational decision-making, and cybersecurity for connected manufacturing. Green-related technical skills such as eco-design, life-cycle assessment (LCA), and emissions monitoring are also critical to ensure technology adoption aligns with sustainability objectives. As one Italian CEO explained, "We need training that is concrete, short, and directly applicable to our work," while a German participant stressed, "Without specific training in AI, IoT, and robotics, we cannot start the transformation." These targeted programmes are seen not only as a way to maximise the potential of new technologies but also to build trust among employees and reduce resistance to change.

2. **Financial support for adoption** (22 mentions):

Financial support is the second major need, enabling SMEs to adopt advanced technologies without compromising financial stability. Companies consistently cited high upfront costs, uncertain return on investment (ROI), and the risk of investing in untested technologies as key barriers. They seek tax incentives, low-interest loans, streamlined access to EU and national grants, and advisory services for preparing strong funding applications. A French SME remarked, "Without easier access to finance, our transformation will stay on paper," while Austrian CEOs pointed out that delayed investment also delays essential workplace improvements linked to technology adoption.

3. **Experiential learning through company visits** (11 mentions):

Company visits are valued for their role in showing how advanced technologies function in real production environments, allowing SMEs to assess their operational and human impact. Observing technology in action helps companies understand integration requirements, evaluate changes in workflows, and assess implications for safety, ergonomics, and job design. As one Slovenian participant stated, "Seeing technology in action makes it easier to trust and invest," while an Italian SME noted, "Real-life examples help us convince both management and staff."

4. **Good practice exchanges** (9 mentions):

Good practice exchanges complement these visits by providing structured, transferable examples of how other SMEs have successfully integrated advanced technologies while maintaining or improving working conditions. They help de-risk adoption by demonstrating workflow adaptations, productivity gains, and strategies for worker involvement. A German SME commented, "Learning from real success stories is more convincing than any presentation," and a French participant added, "We need to see what works in companies like ours."

Additional needs include **sector-specific implementation guidance, regulatory clarity, robust cybersecurity, and leadership development**. One participant concluded: *"Our people still do not trust AI—seeing it in action would help."*

Takeaway

SMEs demand practical training, accessible finance, peer validation, and clear guidance to ensure Industry 5.0 adoption enhances both efficiency and working conditions. Coordinated action is required to align digital innovation, sustainability, and human-centric design at every stage of deployment.

Taken together, these needs show that SMEs require concrete, workplace-focused support to ensure that the adoption of advanced technologies enhances operational efficiency, protects jobs, and improves working conditions. Addressing them will require coordinated action that integrates digital innovation, sustainability goals, and human-centric design into every stage of technology deployment.

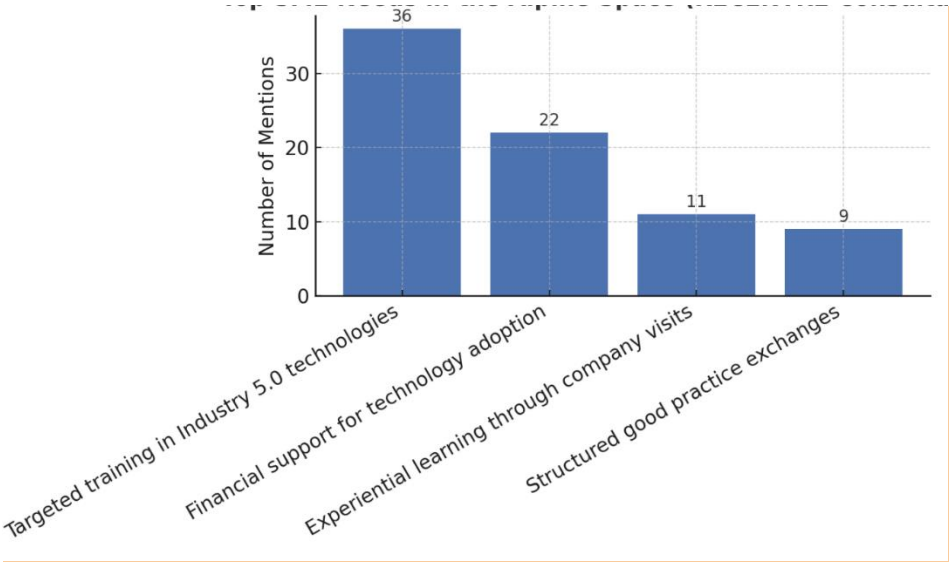

Figure 2:: Common needs from SMEs, own analysis

3.2 EXPECTATIONS OF SMEs

The expectations expressed by Alpine manufacturing SMEs highlight the key conditions they believe must be in place to successfully transition towards sustainable, digital, and human-centred Industry 5.0 practices. These expectations are centred on the tangible benefits and outcomes of adopting advanced technologies—such as AI, IoT, robotics, and digital twins—while also anticipating improvements in work environments and employee well-being. Companies expect access to practical and scalable technological solutions, workforce training aligned with real-world applications, consistent financial and structural support, and effective change management strategies.

3.2.1 INPUT OF ASSESMENT SURVEY

The RECENTRE SME survey, conducted across France, Germany, Italy, and Slovenia, highlights a shared expectation: advanced technologies such as AI, IoT, robotics, eco-design, and sustainability measurement are not just tools for efficiency—they are the foundation for progressing toward Industry 5.0. SMEs stress that their adoption must be accompanied by targeted, practical training that enables workers to integrate these technologies into daily operations.

Training should be concise, hands-on, and directly applicable. As one Italian respondent explained: *"We need training that is concrete, short, and directly applicable to our work."*

A German participant reinforced: *"Without specific training in AI, IoT, and robotics, we cannot start the transformation."*

SMEs further expect adoption to **improve working conditions**—reducing repetitive or physically demanding tasks and freeing employees for creative, higher-value activities. Proof through **company visits and demonstrations** is highly valued: *"Seeing technology in action makes it easier to trust and invest."* (German participant)
"Learning from real success stories is more convincing than any presentation." (Italian respondent)

Finally, SMEs expect **clear rules, accessible funding, and trusted advisory support**. A French respondent summarised: *"We need clear rules and trusted partners to move forward without fear of wasting resources."*

3.2.2 INPUT OF THEMATIC WORKSHOPS

Across the webinars, SMEs emphasised that **integration must be practical and non-disruptive**. One participant warned: *"If integration means stopping our production for weeks, it's simply not an option."*

SMEs expect technologies to **enhance job quality**—automating repetitive tasks, improving safety, and allowing focus on creative roles. Regulatory clarity was repeatedly stressed: *"Regulatory clarity is just as important as the technology itself."* (Webinar speaker)

They demand **proof of ROI through live demonstrations and applied case studies**, since:

"Abstract theories are not enough; we want to see the machines, test the software, and know the ROI before we invest." (Webinar participant)

In human-centric aspects, expectations centred on **short, sector-specific training** (AI, IoT, robotics, CAD, cybersecurity, sustainable production), combined with soft skills (adaptability, collaboration, change management). Leadership engagement was underlined: *"Leadership must be the driver of change; without it, even the best training will not stick."*

3.2.3 INPUT OF LOCAL WORKSHOPS

Workshops across Italy, Slovenia, Germany, France, and Austria confirmed three priorities:

1. **Practical, work-oriented training**

"Training must be practical and adapted to the reality of small companies." (Italian CEO)

"Clear instructions, not just concepts, are needed to make new technology usable." (Slovenian employee)

"Without management explaining the purpose of change, even the best training will fail." (French CEO)

2. **Accessible and predictable funding**

"Funding must fit SME timelines, not the other way around." (German workshop)

"Help us find the right programme and guide us through the process." (Slovenian workshop)

"We cannot commit to investments without knowing if support will be available when we need it." (Italian CEO)

3. **Peer learning & trust-building**

"Seeing a machine working in a factory like ours is worth more than any presentation." (Slovenian participant)

"We want examples from companies of similar size and sector, not just large corporations." (French employee)

"Cross-border exchanges within the Alpine Space help us see what works in similar contexts." (German participant)

Finally, SMEs expect **stable regulatory frameworks**:

"Rules that won't change halfway through a project." (Austrian CEO)
"Simple tools to measure sustainability and communicate results without fear of greenwashing accusations." (French participant).

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3.2.4 INTEGRATED EXPECTATIONS OF SMEs IN ALPINE REGION

By aligning barriers and opportunities across surveys, webinars, and workshops, RECENTRE identified a **clear set of expectations**:

- **Short, sector-specific, hands-on training** (16 mentions)

Ranked first—was repeatedly described as the foundation for any successful technology transition. ***For the digital dimension, SMEs expect such training to equip their workforce with the skills to operate and integrate AI, IoT, robotics, and digital twins into daily processes without disruption.*** From a green perspective, they see it as essential for applying eco-efficient technologies, waste reduction systems, and circular economy practices effectively. In the human dimension, practical training is directly linked to worker confidence, job satisfaction, and reduced stress when using new tools. "Training must be practical and adapted to the reality of small companies," explained an Italian CEO. A Slovenian employee added, "Clear instructions, not just concepts, are needed to make new technology usable." In Austria, participants stressed integrating learning into daily work—"We cannot afford to send people away for weeks; training has to happen while we work"—while in Germany, a CEO underlined, "Without specific training in AI, IoT, and robotics, we cannot start the transformation."

- **Implementation of AI and human-centred AI solutions** (8 mentions)

Ranked second—connects directly to all three pillars. For the digital aspect, it is about deploying intelligent systems that optimize processes, monitor operations, and support decision-making. From a green standpoint, SMEs see AI as a tool to track resource consumption, improve energy efficiency, and reduce environmental impact. In the human pillar, "human-centred" means tools that assist rather than replace workers, automate physically demanding or repetitive tasks, and improve safety. "Technology should help us, not replace us," said a French participant, while an Austrian CEO added, "Human-centred means my team feels in control of the tools, not the other way around." Slovenian participants stressed removing "boring and dangerous parts of the job" so employees can focus on meaningful work, and a German operations manager highlighted safety: "If a robot can take the heavy lifting, that's where we want to start."

- **Promotion of best practices and positive role models** (6 mentions)

Ranked third—was seen as essential for building trust in new technologies and processes***. In the digital pillar, this means learning from SMEs that have successfully implemented advanced tools in similar production settings.*** For the green dimension, it includes examples of companies that have adopted sustainable technologies and can demonstrate measurable environmental benefits. In the human dimension, relatable success stories show how technology can improve working conditions, foster collaboration, and support skills development. "Seeing a machine working in a factory like ours is worth more than any presentation," said a Slovenian participant. An Italian employee noted, "Learning from real success stories is more convincing than any PowerPoint." A German CEO added, "Don't show me what BMW is doing. Show me what a company with 50 people and a limited budget has achieved."

- **Leadership engagement** (5 mentions)

Ranked fourth—also touches all three pillars. ***In the digital context, leaders must allocate resources and set a clear vision for technology adoption.*** In the green context, they must commit to long-term sustainability goals and ensure consistent application of environmental standards. In the human pillar, leadership is about motivating the workforce, communicating the purpose of change, and creating an environment where employees feel involved. "Without management explaining the purpose of change, even the best training will fail," warned a French CEO. Austrian participants added that leadership must "be visible in the change process, not just sign the purchase order," and in Slovenia, a plant manager said simply, "If the boss doesn't believe in it, no one else will."

Additional expectations included establishing **tech–user working groups**, **early employee involvement**, and developing **testing infrastructures** where SMEs can trial technologies before full rollout.

SMEs also expect the creation of tech–user working groups, which for the digital pillar means aligning solution design with operational needs; for the green pillar, developing tools that support sustainable practices; and for the human pillar, ensuring worker input is embedded from the earliest stages. "Too often we get tools that solve problems we don't have," noted a German participant. Early employee involvement has similar cross-pillar relevance— "If we are involved from the beginning, we can avoid mistakes and make it fit our reality," said an Italian worker representative.

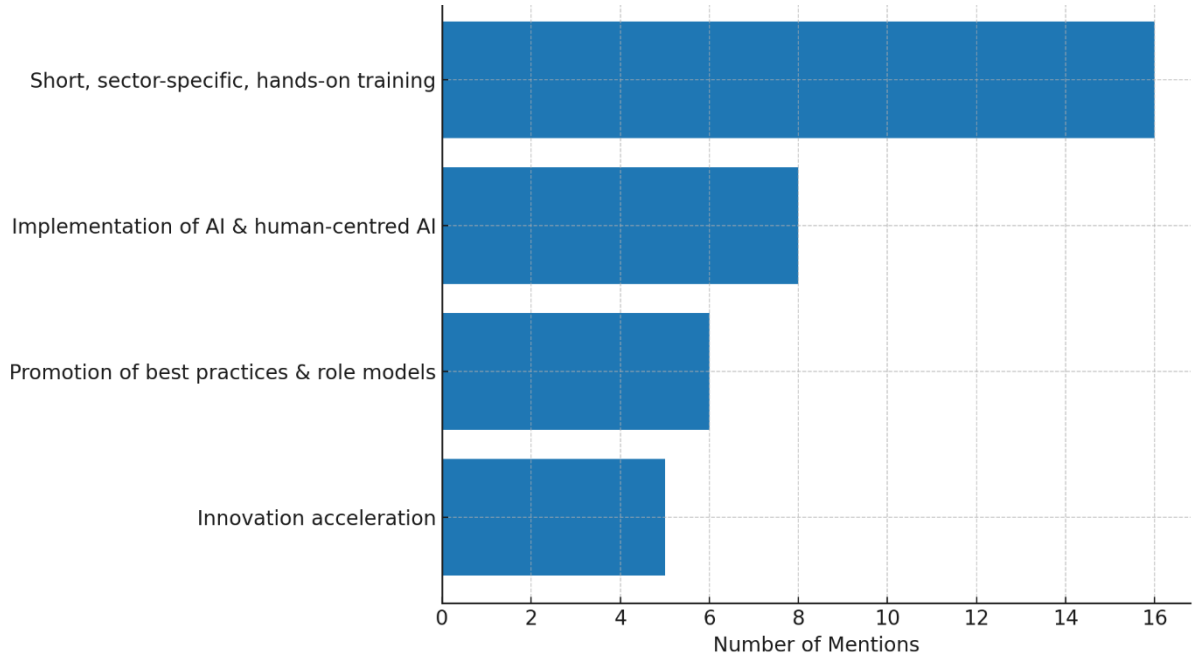

Figure 3: Common expectations from SME, own source

KEY TAKEAWAY

Opportunities identified also have a three-pillar impact. Innovation acceleration supports digital competitiveness through SME-tailored technologies, green benefits through eco-efficient solutions, and human benefits by improving workplace quality. EU-funded support can finance both digital transformation and green retrofitting, while enabling training and skills programmes for workers. Attracting young talent is equally relevant to all three pillars: modern technologies appeal to tech-savvy recruits, sustainability commitments attract environmentally conscious workers, and human-centric workplaces help retain skilled staff. “Young people want to work with modern tools in modern workplaces, and if we can offer that, we can keep them,” said a German HR manager.

Taking these expectations form a transformation pathway that reinforces the interconnection of the three pillars: digital technologies must be implemented in ways that advance sustainability goals and strengthen human well-being, while green innovations and human-centered approaches must be supported by the right digital capabilities. Or as one Austrian participant summarized: “Give us the skills, show us the proof, and make the rules clear—then we will invest.”

4. AREAS OF ALIGNMENT

4. 1 AREAS OF ALIGNMENT

Objective of the RECENTRE project is to ensure that its support mechanisms for SMEs are grounded in both empirical evidence and practical relevance. To achieve this, the consortium analysed findings from SME surveys, national and transnational workshops, and stakeholder webinars. This triangulation enabled a comprehensive understanding of the commonalities between SME needs and expectations across the Alpine region.

The analysis identified four thematic areas where SME needs and expectations converge. These alignment zones represent priority fields for designing targeted support interventions. Two areas demonstrate full alignment, where needs, expectations, and implementation readiness are all strongly present. The remaining two show partial alignment, indicating shared priorities that require further development, support infrastructure, or system-level action to be effectively addressed.

1. Short, Sector-Specific, Practical Training

This area emerged as the most consistently aligned across all data sources. SMEs across all regions and sectors expressed a strong and urgent need for **short-duration, sector-specific, and practical training programmes**. This aligns directly with their expectations for support formats that are realistic in terms of time investment and immediately applicable to their operational context.

Training is considered a prerequisite for the successful adoption of: **Digital technologies** (e.g. AI, IoT, robotics, digital twins), **Green practices** (e.g. eco-design, life-cycle assessment, emissions monitoring) and **Human-centred transformation** (e.g. improving usability, safety, and employee confidence).

2. Peer Learning, Site Visits, and Role Models

SMEs across all countries indicated a strong preference for **experiential learning** formats, including site visits, peer exchanges, and the promotion of relatable success stories. These methods are perceived as essential for building trust in new technologies and de-risking transformation.

Peer learning enables SMEs to: Observe digital technologies in operational environments, Understand implementation pathways for green innovation and Assess the human impact of transformation through real-world examples.

The strong alignment between SME needs and expectations in this area supports the inclusion of structured learning formats in RECENTRE toolkits and regional support systems.

Figure 4: Areas of full alignment, own source

4.2 AREAS OF PARTIAL ALIGNMENT

3. Implementation of AI and Human-Centred AI Solutions

SMEs recognise the strategic relevance of AI, particularly for process optimisation, monitoring, and decision support. However, their expectations are centred around “human-centred AI”—solutions that assist rather than replace employees.

4. Financial support for technology adoption

Financial support remains the second most frequently mentioned need for SMEs. While the need is strongly articulated (access to grants, expert help, de-risking), expectations focus on **streamlined, guided, and low-bureaucracy** mechanisms. This gap between need and realistic access pathways constitutes a partial alignment.

5. Innovation Acceleration and experiential learning

SMEs expressed their expectation in structured testing infrastructures and early validation environments, but the need for innovation was not mentioned directly in the needs list.

Figure 5: Areas of partial alignment, own source

By mapping out both full and partial alignment zones, RECENTRE is equipped to prioritize its interventions. Areas of full alignment (training, peer learning) should be targeted with immediate support actions. Partial alignment areas (AI implementation, financial support, innovation acceleration) should be developed further through pilot testing, expert involvement, and systemic scaffolding, to bridge the gap between SME expectations and operational feasibility.

CONCLUSION

RECENTRE project partners have successfully reached **367 SMEs** through three sets of activities. The initial goal was to engage 450 SMEs, primarily from the manufacturing sector. While significant outreach was achieved, this target could not be fully met due to a mix of geopolitical, economic, and organisational factors.

Firstly, **Industry 5.0 remains at an early stage of development**, with limited availability of well-documented good practices, case studies, and accessible information. This lack of concrete reference points made many SMEs hesitant to engage, as the benefits of Industry 5.0 are not yet widely understood or perceived as directly applicable.

Secondly, the **absence of Swiss partners** restricted outreach, as Swiss SMEs could not be included in the project's activities and results.

Thirdly, the **uncertain European economic climate** further constrained participation. Many SMEs prioritised short-term survival and cost optimisation over exploration engagement in transformation-oriented initiatives. Many businesses support organizations

in all project regions offer support programs of different kinds that were, in this case, competition to the RECENTRE outreach to companies. Moreover, In France, participation was additionally affected by the overlap of key project events with major trade fairs, reducing webinar attendance.

Finally, **differences in national innovation ecosystems** led to varying levels of awareness and interest across partner regions. The organisational complexity of coordinating activities across multiple countries also limited the scope of outreach.

Given the lower-than-expected response rate to the **survey** (53 SMEs), compared to the overall target of reaching approximately **450 SMEs across all activities** (survey, webinars, and workshops), the survey results will **not carry the same analytical weight** as originally intended. They will therefore be treated with a **reduced ponder** in the final synthesis, contributing approximately **15%** to the total evidence base.

The interpretation of SME needs, barriers, and expectations will instead be **primarily rely on the local workshops (46%) and webinars (39%)**, which engaged a broader and more diverse set of stakeholders — including both company leadership and employees — across partner regions.

This **adjusted weighting** ensures that the analysis remains **methodologically sound and reflective of the broader innovative ecosystem**, despite the limited participation in the survey itself.

At the same time, the analysis of SME input across surveys, workshops, and webinars highlighted clear alignment areas between SME needs and expectations. Two domains represent full alignment: the call for short, sector-specific, hands-on training as the cornerstone of transformation, and the demand for peer learning opportunities through company visits and positive role models. These areas are consistently recognised as both the most urgent needs and the most important expectations, providing immediate entry points for RECENTRE support. In addition, three domains demonstrate partial alignment: the implementation of AI and human-centred AI solutions, the provision of financial and implementation support, and innovation acceleration through testbeds and demonstrators. These areas are strategically important but require further development, systemic enablers, and validation to bridge the gap between SME expectations and practical application.

Taken together, these findings underline both the achievements and the challenges of RECENTRE's first phase. While the outreach target was not fully met, the project succeeded in identifying where SMEs are most ready to act, and where gaps remain. The alignment analysis provides a roadmap: to focus immediate efforts on training and peer learning, while progressively building capacities, financial mechanisms, and innovation infrastructures that will allow SMEs in the Alpine region to embrace Industry 5.0 in a practical, inclusive, and sustainable way.

ANNEXES:

- Annex 1: Assessment survey form
- Annex 2: Webinar 1: Ai & Industry 5.0 agenda and post event assessment survey
- Annex 3: Webinar 2: Empowering worker skills for Industry 5.0 -agenda and post event assessments
- Annex 4: Webinar 3: Green transition on Industry 5.0 - agenda and post event assessment
- Annex 5: Local workshop T2i for CEOs - report
- Annex 6: Local workshop T2i for employees - report
- Annex 7: Local workshop Trentino Sviluppo for CEOs - agenda
- Annex 8: Local workshop Trentino Sviluppo for employees - agenda
- Annex 9: Local workshop Technology Park Ljubljana for employees (agenda
- Annex 10: Local workshop Technology Park Ljubljana (PP04) for CEOs agenda
- Annex 11: Local workshop Bayern Innovative (PP06) for employees -agenda
- Annex 12: Local workshop Bayern Innovative (PP06) for CEOs - agenda
- Annex 13: Local workshop Steinbeis Europa Zentrum (PP07) for employees agenda
- Annex 14: Local workshop CCI Alsace Eurométropole (PP09) for CEOs agenda
- Annex 15: Local workshop CCI Alsace Eurométropole (PP09) for employees agenda
- Annex 16: Local workshop CREATION OF INTEGRATED MECHANICAL SYSTEMS - FRANCE (employees and CEOS - report
- Annex 17: Local workshop Business Upper-Austria (PP11) for employees' agenda
- Annex 18: Local workshop Business Upper-Austria (PP11) for CEOs agenda