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BEST4.0
Deliverable D.2.2.2
Cross Border Orientation Plan

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Cross Border Orientation Plan

1. Introduction

Objective

The Cross Border Orientation Plan (Deliverable **D.2.2.2**) is a key output of **Work Package 2 (WP2), Activity 2.2**, aimed at supporting the creation and consolidation of the Cross-Border Digital Innovation Hubs (DIH) Network established by the BEST4.0 partnership. It provides a structured strategic framework that connects (i) the evidence collected through territorial mapping and stakeholder engagement activities carried out in the previous phases of the project, with (ii) the operational Industry 4.0 service offer jointly developed under WP2. In this sense, the document acts as a bridge between territorial priorities and the practical deployment of digital innovation services within the Italy–Croatia cooperation area.

D.2.2.2 **is complementary** to Deliverable **D.2.2.1** ("Action Plan for Testing the I4.0 Service Catalogue"), which defines the operational roadmap and procedures for validating and testing the shared service catalogue with SMEs during WP3. While D.2.2.1 focuses on how services will be implemented and tested, this Orientation Plan clarifies why and where such services are strategically relevant, by aligning them with regional Smart Specialisation Strategies (S3) and cross-border innovation priorities.

This deliverable is not intended to replicate or replace regional S3 documents, nor to provide a comprehensive review of each regional strategy. Instead, it synthesises recurring trajectories and shared priorities across the cooperation area and translates them into a coherent strategic framework supporting S3 authorities, policy makers, and innovation stakeholders in positioning BEST4.0 results within existing policy instruments.

By consolidating the outcomes of the cross-border exchange visits and the joint partner work under Activity 2.2, the Orientation Plan provides strategic guidance for the next implementation stage of the project, ensuring continuity between territorial mapping, service portfolio structuring, and subsequent pilot deployment under WP3. As such, it serves as a reference framework for WP3 pilot actions, facilitating a consistent interpretation of service uptake, effectiveness, and impact in relation to regional S3 trajectories and cross-border priorities.

Scope of the Report

This document captures the outcomes of the two cross-border exchange visits and the collaborative work carried out within Activity 2.2. It presents an overview of the Blue Economy sectors and innovation fields prioritised across the participating regions, aligned with their current Smart Specialisation Strategies.

Furthermore, the report provides a structured synthesis of how the shared I4.0 service portfolio responds to identified territorial needs and outlines recommendations and actions to be shared with S3 responsible authorities and policy makers. Through this structure, the Orientation Plan supports a coherent reading of the project's contribution to regional innovation ecosystems and cross-border cooperation.

2. Methodological Approach

The Orientation Plan is the result of an iterative co-design process involving project partners and associated organisations (AOs), using inputs collected from multiple sources:

- **Exchange Visits:** Two cross-border visits (Croatia and Italy) provided opportunities for direct engagement with innovation ecosystems, DIH facilities, and Blue Economy stakeholders. These visits represented a core methodological step in the co-design process, enabling partners to collect evidence, compare S3 priorities, and structure the shared I4.0 service offer.
- **Regional Conferences**: Events such as the Regional Conference served as platforms to share pilot activities, discuss challenges in aligning services to policy priorities, and engage SMEs and institutional actors.
- **Involvement of Associated Organisations (AO1 and AO2):**
    - **AO1: M.A.R.E. FVG** contributed with strategic insights on smart shipbuilding, waterborne transport, and green offshore systems. As a regional maritime cluster with a role in S3 EDP, it ensured alignment with Friuli Venezia Giulia's development trajectories.
    - **AO2**: **SVEUCILISTE U RIJECI / EDIH Adria** supported the identification of digital innovation opportunities in port logistics, VR training, smart shipping, and simulation-based learning. Its facilities played a key role in piloting service demonstrations under BEST 4.0.
- **Partner Involvement:** Each project partner actively contributed to the alignment process by mapping regional S3 priorities and identifying corresponding services from the shared I4.0 catalogue. This facilitated a bottom-up matching between innovation needs and digital enablers.
- **Comparative Analysis of regional Smart Specialisation Strategies**: A structured comparison of regional S3 strategies revealed common thematic priorities (e.g., shipbuilding, sustainable aquaculture, smart tourism) and inspired shared policy recommendations.

This structured approach has ensured that the deliverable reflects both top-down policy alignment and bottom-up operational relevance.

3. Key Inputs and Outcomes of the Cross-Border Exchange Process

To improve the readability of the report and highlight the added value of the cross-border exchange process carried out within Activity 2.2, the following table provides a concise overview of its main outcomes. Rather than repeating a partner-by-partner narrative, this synthesis captures the key strategic results that emerged from the joint work, showing how the exchange visits contributed to aligning territorial needs, regional S3 priorities, and the shared I4.0 service portfolio developed under WP2. The table clarifies how these moments of direct interaction acted as a strategic bridge between territorial mapping activities and the operational structuring of the Cross-Border DIH Network.

Cross-border exchange visits — Key outcomes at a glance

Exchange visit	Main focus	What we observed / discussed	Concrete outputs for the project	How it acts as a "bridge" (services ↔ territorial mapping)
Visit 1 **Croatia (Šibenik)**	Understanding the Croatian innovation ecosystem and Blue Economy stakeholders; aligning service needs with regional priorities	Visits to innovation actors and facilities; comparison of partner approaches; discussion on DIH Network structure and first draft of the I4.0 service catalogue; identification of synergies and complementarities	Consolidation of shared vision on DIH Network governance; first alignment between **regional priorities** and **service categories**; inputs for refining the catalogue structure	Territorial needs and S3 trajectories gathered on-site are translated into a preliminary matching with service areas (business improvement, I4.0 applications, capacity building)
Visit 2 **Italy (Brindisi)**	Deepening technical/service readiness and preparing implementation mechanisms	Presentation of demonstrators and labs (I4.0 applications); joint review of the **Action Plan for Testing**; discussion on how to	Shared understanding of how services can be implemented and communicated locally; reinforcement of a	Services are "operationalised": the visit connects **where** the needs are (territories) with **how** the DIH network can deliver them (testing

Exchange visit	Main focus	What we observed / discussed	Concrete outputs for the project	How it acts as a "bridge" (services ↔ territorial mapping)
		promote services in each territory	common operational approach for testing and uptake	plan + implementation pathways)
Cross-visit joint work (partnership collaboration)	Ensuring cross-border coherence and policy relevance	Comparison of S3 priorities across regions; dialogue with associated organisations; discussion on engaging S3 authorities and public administrations	**Validated list of services** across three categories; **recommendations** for policy makers; **cross-analysis of S3 priorities** and shared thematic convergences	Creates an explicit linkage between: (1) mapped regional trajectories (S3), (2) a structured service offer (catalogue), (3) policy-facing recommendations enabling scale-up and integration

Building on this shared overview, the following sections provide a partner-level perspective on the exchange activities, highlighting local ecosystems, S3 priorities, and specific contributions to the Cross-Border DIH Network and the I4.0 Service Catalogue.

4. Strategic Alignment between Regional S3 Priorities and BEST4.0 I4.0 Services

Building on the outcomes of the cross-border exchange process, this section consolidates the strategic alignment between recurring S3 trajectories identified across the cooperation area and the Industry 4.0 service portfolio developed within BEST4.0. Rather than describing regional strategies individually, the table below synthesises common innovation priorities and maps them against the shared I4.0 service

categories. This structured alignment provides a policy-oriented framework supporting both the implementation of WP3 pilot actions and the long-term integration of services into regional Smart Specialisation Strategies.

Cross-Regional S3 Trajectory	Examples of Regional Focus	Relevant BEST4.0 Service Categories	Added Value of the Cross-Border DIH Network	Policy Relevance for WP3 Pilot Implementation
Sustainable Shipbuilding & Maritime Manufacturing	Emilia-Romagna, FVG, Apulia, Rijeka	I4.0 applications; Digital prototyping; Simulation; Robotics; Advanced materials	Shared access to testing facilities, simulation labs, and digital validation tools across regions	Prioritisation of SMEs in maritime value chains for pilot testing of digital prototyping, robotics and smart manufacturing services
Sustainable Aquaculture & Fisheries	Apulia, Istria, Split-Dalmatia, Šibenik-Knin	IoT monitoring; AI-based analytics; Traceability tools; Capacity building	Cross-border transfer of tested digital solutions for eco-sustainable production	Implementation of IoT and AI pilots in aquaculture SMEs; validation of traceability and monitoring systems
Smart Ports & Maritime Logistics	Rijeka, Trieste, Ferrara	Process optimisation; AI; Digital twins; IoT; Predictive maintenance	Integration of logistics, data analytics and digital simulation expertise	Selection of SMEs and port-related actors for testing AI-based optimisation and digital twin solutions
Smart & Experiential Coastal Tourism	Apulia, Marche, Split-Dalmatia, PGC	VR/AR; Co-design services; Digital storytelling; Business improvement	Integration of creative industries and digital tools across coastal regions	Deployment of immersive technologies in tourism SMEs and validation of experiential digital services
Skills Development & Digital Upskilling	All regions	Capacity building; Training; TML assessment; Mentoring	Harmonised approach to digital maturity assessment and skill development	Use of TML index to select SMEs for WP3 pilots and monitor service uptake and digital readiness evolution

5. Governance and Long-Term Sustainability of the Cross-Border DIH Network

The strategic alignment achieved through the cross-border exchange process and the structured mapping between S3 trajectories and the BEST4.0 I4.0 service portfolio is institutionally reinforced through the Memorandum of Understanding (MoU) signed by the project partners within WP2. The MoU does not represent a formal or symbolic agreement, but establishes a concrete governance framework ensuring the continuity of the Cross-Border DIH Network beyond the experimental phase of the project.

In particular, the MoU formalises the shared commitment of partners to maintain, periodically review, and update the I4.0 Service Catalogue over time, ensuring its alignment with evolving regional Smart Specialisation Strategies, emerging technological trends, and the changing needs of Blue Economy SMEs. It also foresees the revision of the Orientation Plan itself, enabling the document to remain a dynamic reference framework rather than a static project output.

This governance model is further supported by the Operational Rules of the Cross-Border DIH Network, which define mechanisms for periodic review, coordinated decision-making through a Steering Committee, and consensus-based updates of services and priorities. Through these mechanisms, the Catalogue becomes a living operational tool of the network, capable of integrating feedback from WP3 pilot actions and monitoring activities into future strategic updates.

By linking service provision, policy alignment, and structured governance, the MoU strengthens the role of the Cross-Border DIH Network as a sustainable bridge between regional innovation strategies and practical implementation. It ensures that the results of WP2 are not limited to a pilot framework, but evolve into a long-term cooperation model supporting continuous digital transformation in the Blue Economy across the Italy–Croatia cooperation area.

5.1 Monitoring Framework for Service Uptake and S3 Impact

In order to ensure the effective implementation and long-term sustainability of the Cross-Border DIH Network, a structured monitoring approach will accompany the deployment of WP3 pilot actions. This framework will allow partners to assess not only the uptake of I4.0 services by SMEs, but also their contribution to regional Smart Specialisation trajectories.
The monitoring activities will focus on a limited set of qualitative and quantitative indicators, including:

- Number of SMEs engaged per S3 priority area
- Type and category of I4.0 services activated (business improvement, applications, capacity building
- Evolution of Technology Maturity Level (TML) before and after service delivery

- Degree of cross-border service provision (services delivered by partners outside their home region)
- Evidence of integration of I4.0 services into regional policy instruments or funding schemes

The results of this monitoring will feed into the periodic review of the I4.0 Service Catalogue foreseen under the Memorandum of Understanding, ensuring a continuous alignment between territorial needs, policy priorities, and digital innovation services.

6. Partner Contributions to the Cross-Border Orientation Plan

6.1 Strategic Inputs to the Orientation Plan

6.1.1 PP3 – CETMA – Methodological and Technological Input

Within the Cross-Border DIH Network, CETMA contributes a specialised portfolio of immersive design, digital ergonomics, and advanced material validation services, directly supporting Blue Economy SMEs operating in shipbuilding, marine equipment, and experiential tourism.

The exchange visits organised within the framework of the BEST4.0 project provided key inputs for the development of the Cross Border Orientation Plan. The two visits — held in Šibenik (Croatia) and Brindisi (Italy) — represented fundamental steps towards strengthening the cooperation among project partners, aligning the I4.0 services developed by the Cross-Border DIH Network with the S3 trajectories of the participating regions, and fostering dialogue with S3 responsible authorities.

The first exchange visit, hosted by DIH Agrifood Croatia, offered the opportunity to explore the innovation ecosystem and advanced services supporting the Blue Economy sector in Croatia. Partners visited the AluTech Innovation Centre, the Ruđer Bošković Institute, and the Blue Living Lab dedicated to aquaculture innovation. During the project meeting, partners jointly discussed the structure and governance of the Cross-Border DIH Network, the draft Memorandum of Understanding, and the preliminary I4.0 service catalogue, identifying synergies and complementarities among their respective service offerings.

The second exchange visit, hosted in Brindisi, deepened this collaborative work. Partners were introduced to advanced laboratories and demonstrators for I4.0 applications, including robotics, virtual and augmented reality, and smart materials, with a particular focus on supporting SMEs in the Blue Economy. The visit also included a joint review of the *Action Plan for Testing the I4.0 Service Catalogue*, providing a shared understanding of how to promote and implement these services within each regional ecosystem.

As an outcome of both exchange visits, several key elements were consolidated and feed directly into this Cross Border Orientation Plan:

- A shared list of I4.0 services structured around business improvement, I4.0 applications, and capacity building, jointly validated by all partners.
- An analysis of complementarities among partner service offerings, fostering cross-border cooperation.

- Recommendations for engaging S3 responsible authorities and public administrations, in order to promote the integration of I4.0 services into regional innovation strategies.
- A cross-analysis of current S3 trajectories and priorities, identifying common focus areas such as sustainable shipbuilding, smart aquaculture, marine robotics, and advanced environmental monitoring.
- Strategic guidance for the promotion and dissemination of the I4.0 Service Catalogue towards SMEs and policy makers.

CETMA's contribution complements the service portfolios of other partners by strengthening the network's capabilities in virtual validation, advanced materials engineering, and human-centred design, reinforcing the cross-border value chain in maritime innovation.

6.1.2 AO1 - M.A.R.E. FVG S.c.a r.l.- Strategic Maritime Cluster Input

The Maritime Aerospace Renewable Energies Technology Cluster FVG – M.A.R.E. FVG is a technology cluster established in 2012 as a limited liability consortium at the top of the Adriatic Sea. It currently includes 48 shareholders, 30 members and more than 200 stakeholders belonging to traditional maritime sectors of ship- and boatbuilding, waterborne logistics and transport, leisure boating, offshore systems and emerging sectors of aquaculture, marine robotics and renewables from the sea. M.A.R.E. FVG is a member of the EU technology platform WATERBORNE and at national level, M.A.R.E. FVG is one of the 4 regional maritime clusters with which there is a mutual collaboration expressed also in the joint participation in the 2 national technology clusters. Moreover, in the National Technology Cluster for surface mobility, M.A.R.E. FVG has been the national coordinator of the Waterborne working Group since 2015. M.A.R.E. FVG is an active actor of the regional S3 EDP process since 2015; specifically in 2020 it coordinated the regional work group on Waterborne mobility and its land connections under a specific request of the Regional Government of the Region Friuli Venezia Giulia.

Sector of Expertise

- Cruise ships
- Leisure yachts
- Marinas
- Maritime transport
- Marine energy
- Offshore systems
- Refitting and maintenance
- ROV
- AUV
- Marine monitoring and observation

The cluster works in close cooperation with large companies, SMEs, research centers, port authorities, classification societies, as well as with other regional, national and international clusters and innovation hubs.

Overview of Available Facilities

Technological Capabilities and Resources
Stakeholder network: public-private, academia, SMEs, and industrial actors, each with their own specific technological resources. Strong ties with universities, research institutes and laboratories
Innovation delivery: ability to maximize synergies with international R&D projects
Observatory: industrial mapping, skills gap analysis and partnership facilitation
Cross-sector expertise and governance: integration of capabilities and resources from the maritime industry with aerospace and renewable energies

Input: STEP – Activities (S3 Authorities)

M.A.R.E. FVG plays an active role in the Smart Specialisation Strategy (S3) governance of Friuli Venezia Giulia. Since 2015, the cluster has been involved in the Entrepreneurial Discovery Process (EDP) promoted by the regional administration, specifically coordinating the **working group on Waterborne Mobility and its land connections**. This group contributed to defining the S3 trajectory on **Maritime Technologies**, now a strategic pillar of the regional innovation policy.
Within the BEST 4.0 project, M.A.R.E. FVG leveraged this strategic position to act as an interface between **innovation service providers and regional policy-makers**, ensuring that project results (e.g. the I4.0 Service Catalogue, TML Index) are in line with S3 priorities. As a key actor in the national and EU innovation ecosystem (e.g. WATERBORNE TP), M.A.R.E. FVG supports policy alignment beyond the regional level, contributing to strategic convergence within the Italy-Croatia cooperation area.

6.1.3 AO2 - SVEUCILISTE U RIJECI / EDIH Adria- Digital Infrastructure Input

The Faculty of Maritime Studies, part of the University of Rijeka, is Croatia's premier institution dedicated to maritime education, training, and applied research. With decades of experience and a strong presence in the Adriatic region, the Faculty plays a strategic role in supporting the development of a modern, sustainable, and innovation-driven maritime sector.
As a key regional stakeholder in the blue economy and digital transition, the Faculty provides multidisciplinary academic programmes and conducts advanced research aligned with the needs of the maritime industry. It has extensive involvement in national and EU-funded initiatives, particularly in the fields of smart maritime technologies, simulation-based learning, and green marine engineering.

Sector of Expertise

- Maritime Transport and Navigation
- Marine Engineering and Propulsion Systems
- Virtual Reality (VR), Augmented Reality (AR), and Simulation in Maritime Education
- Port and Logistics Systems
- Environmental Protection and Energy Efficiency in Maritime Contexts
- Digitalisation and Automation in Maritime Operations
- Human Factors, Competency Development, and Safety at Sea
- Blue Economy Innovation and Industry-Academia Collaboration
- The Faculty actively collaborates with maritime companies, port authorities, startups, and research networks to co-develop technological solutions and address real-world challenges in maritime operations and sustainability.

Overview of Available Facilities

- Full Mission Bridge Simulator (Class A) for navigational training
- Engine Room Simulator (ERS) for marine engineering operations and diagnostics
- EVR Lab (Engine Room Virtual Reality Lab) – an advanced facility using Head-Mounted Display (HMD) VR systems to simulate engine room environments, allowing immersive training experiences for diagnostics, procedures, and safety drills
- Cargo Handling and Ship Stability Simulation Lab
- GMDSS and Maritime Communication Labs
- Survival and Maritime Safety Training Equipment
- Port Operations and Logistics Simulation Platform
- Digital Tools and AI-Enhanced Systems for Smart Shipping
- Research Laboratories for Energy Systems and Environmental Monitoring
- Integration with local innovation ecosystem, including SmartRI, Technology Park Rijeka, and regional maritime tech developers
- The EVR Lab, as part of the BEST4.0 initiative, plays a key role in piloting immersive learning environments and evaluating their impact on knowledge retention, skill development, and student motivation. It exemplifies the Faculty's commitment to bridging cutting-edge technology with practical maritime training, supporting the green and digital transition in maritime education.
- Technological Capabilities and Resources

Input: STEP – Activities (S3 Authorities)

The Faculty of Maritime Studies at the University of Rijeka is a key knowledge institution embedded in the regional S3 framework of Primorje-Gorski Kotar County. Through its academic and applied research activities, the Faculty regularly contributes to the Entrepreneurial Discovery Process and consultative

mechanisms promoted by the Croatian Ministry of Economy and Sustainable Development and the Regional Development Agency of Primorje-Gorski Kotar.
PFRI plays a central role in defining the regional strategic direction for digitalisation of port operations, green shipbuilding, and simulation-based training—all recognised priorities in the county's S3.
Furthermore, the Faculty collaborates with innovation infrastructure providers (e.g. SmartRI, Technology Park Rijeka) and participates in S3 implementation roundtables focused on maritime innovation and education reform. This engagement ensures that project outputs are embedded into regional planning and reinforce long-term innovation pathways identified by the S3.

6.2. Regional Orientation Profiles

In this section, each project partner provides a structured analysis of how the BEST 4.0 I4.0 services align with their respective regional Smart Specialisation Strategy (S3). The contributions follow a common format that enables comparability across regions and highlights opportunities for cross-border synergies. Specifically, each partner outlines:

- A brief overview of their regional S3 strategy and its innovation framework;
- The Main Blue Economy sectors prioritised within their S3;
- Relevant innovations developed through the BEST 4.0 project that support these sectors;
- The degree of alignment between the I4.0 service offer and regional S3 trajectories, including practical considerations for integration into local and regional policy frameworks.

This shared structure ensures that each regional perspective contributes to a coherent understanding of strategic alignment, supporting the implementation of the Cross-Border Orientation Plan.

6.2.1 Project Area n.1 : LP CNA FERRARA

- **Regional S3 Strategy Summary**

  The Smart Specialisation Strategy (S3) 2021–2027 of Emilia-Romagna serves as the strategic framework guiding investments in research and innovation. It aligns with the "Pact for Work and Climate" to promote sustainable, digital, and inclusive development.

  The main objectives include environmental sustainability, digital transition, social inclusion, health and well-being, and strengthening regional competitiveness. The strategy seeks to integrate technological innovation with socio-economic transformation.

  S3 identifies 15 cross-sectoral priority themes, such as big data, artificial intelligence, sustainable mobility, blue economy, innovative tourism, and cultural heritage.

  Key production systems include agri-food, mechatronics, motor vehicles, construction, health industries, energy, and culture, alongside emerging sectors like aerospace and critical infrastructure.

The regional research ecosystem includes 82 research labs, 10 technology parks, 7 Clust-ER associations, 27 incubators, a network of Fab Labs, and 65 research infrastructures, coordinated by ART-ER.
Priority actions are organized into 6 pillars:

- Strengthening technology parks and research infrastructures.
- Strategic innovation and system projects.
- Advanced training and skills development.
- Support for startups and innovative enterprises.
- Implementation of the Digital Agenda and the "Data Valley".
- Networks and partnerships for European cooperation.

The governance model is multi-level, participatory, and inclusive, with a monitoring system using output and specialisation indicators to assess implementation and impact.
The estimated total investment is €5 billion: €2.7 billion in public funding and €2.3 billion from private sources, supported by European, national, and regional funds (FESR, ESF, PNRR, Horizon Europe, Digital Europe, etc.).

- **Main Blue Economy related sector**
  Blue Growth focuses on the sustainable development of marine and coastal resources, aiming to enhance the economic potential of the sea through innovation and environmental responsibility. The related Emilia Romagna S3 strategy is structured into three main areas: blue bioeconomy, maritime manufacturing, and coastal/tourism development 2.0.

  - Scope and Innovation Areas: Blue Bioeconomy: includes sustainable and circular fishing and aquaculture, marine biodiversity, biotechnology to extract resources from algae and fish, and pollution mitigation.
  - Maritime Manufacturing: encompasses marine renewable energy (e.g., offshore wind), sustainable shipbuilding, marine robotics, and repurposing offshore platforms.
  - Coastal Zone and Tourism 2.0: involves environmental and infrastructure regeneration, coastal monitoring, and smart, sustainable tourism.
  - Relevance for Emilia-Romagna
    - With 135 km of coastline, the region leads in marine environmental services, biodiversity, and landscape quality. Three key coastal areas are identified:
    - Ferrara: aquaculture and food processing;
    - Ravenna and Forlì-Cesena: offshore industry, shipbuilding, port and coastal infrastructure;
    - Rimini: a national coastal tourism hub.
  - Global Trends and Criticalities
    - Negative trends: growing human pressure on marine ecosystems, climate change, and the decline of traditional fisheries.

  - Positive trends: growth in coastal tourism, expansion of marine renewables, and diversification of shellfish farming (e.g., oysters).
- Development Pathways
  - Blue Bioeconomy: revitalize fisheries through digitization (product traceability, illegal fishing monitoring), improved energy efficiency and product shelf-life. Focus on aquaculture and shellfish farming with low-impact technologies and species diversification.
  - Blue Biotechnologies: valorize fish waste and algae to extract proteins, vitamins, and nutraceuticals. Microalgae cultivation is promising but requires integrated supply chains
  - Pollution Prevention: adopt integrated approaches for marine waste recovery, emerging contaminant mitigation, microplastic classification, and advanced monitoring technologies.
- Marine Manufacturing
  - Strong focus on offshore wind and marine renewables, with regional pilot projects.
  - Sustainable reuse of offshore infrastructure through integrated innovations.
  - Development of marine robotics for monitoring, safety, and environmental management.
- Coastal Zone and Tourism
  - Coastal infrastructure regeneration (including low-cost remote monitoring), flood and erosion prevention, and improved maritime safety.
  - Development of Tourism 2.0: technology-driven regeneration, participatory models, and data-based planning for sustainable, high-quality coastal tourism.
- Strategic Outlook
- Sustainable tourism: coastal regeneration, sustainable mobility, energy infrastructure, and local products.
- Ecological transition of oil & gas: leveraging existing energy infrastructure and engaging major players to drive offshore renewable innovation.
- Blue biotechnologies: high innovation potential for marine-derived industrial uses (pharma, cosmetics, food, textiles, environment, energy).
- Circular economy: essential for closing the production cycle and fostering a regenerative marine economy.
- Innovation
  - The digital and technological transition is cross-cutting across all Blue Growth development paths, even if not addressed in a standalone section. It is considered a key enabling condition to:
  - -modernize traditional sectors (fishing, tourism, shipbuilding),
  - -enhance sustainability,
  - -boost competitiveness and climate resilience,

- attract investments and lead industrial reconversion.

- **Main Innovation connected to our project**
  The BEST4.0 project is fully consistent with the Emilia-Romagna Smart Specialisation Strategy (S3) for Blue Growth 2021–2027, as it addresses some of the main development paths identified by the strategy—particularly the need for digital transformation and technological innovation in both traditional and emerging sectors of the blue economy.
  The S3 emphasizes the urgency of introducing digital technologies, automation, traceability systems, and environmental monitoring tools in sectors such as fishing, aquaculture, shipbuilding, coastal tourism, and marine protection. BEST4.0 responds directly to this need by applying Industry 4.0 principles through a cross-border network of Digital Innovation Hubs (DiHs), helping to bridge the innovation gap between territories with different levels of performance.
  In particular, BEST4.0 promotes the digitalization of Blue Economy SMEs through cross-border I4.0 catalogues, tailored support, and capacity building programs. This approach is perfectly in line with S3 goals to increase the adoption of advanced technologies and strengthen collaboration between businesses and research centers—a strategic priority for the Region.
  The S3 also identifies the engagement of innovation ecosystem actors—including incubators, development agencies, labs, and clusters—as a key driver for growth in the marine sector. BEST4.0 fosters this cross-border cooperation, improving access to innovation and accelerating the shift toward a sustainable, digital, and resilient blue economy. For these reasons, BEST4.0 can be seen as a concrete and operational implementation of the S3 strategy.

- **Contribution to the Cross-Border I4.0 Service Ecosystem**
  The Emilia-Romagna region's Smart Specialisation Strategy (S3) identifies sustainable industrial innovation, digital transition, and Blue Economy as key drivers for competitiveness. Within this framework, CNA Ferrara plays a pivotal role as a Digital Innovation Hub (DIH) under the CNA HUB 4.0 network, supporting over 5,200 SMEs across various sectors including shipbuilding, tourism, and environmental services.
  CNA Ferrara offers a comprehensive set of I4.0 services that align closely with the regional S3 priorities. These services include business and digital transformation assessments, process and product innovation support, training and skills development, financial advisory, and internationalisation strategies. Through its strong connection with regional innovation stakeholders (research centers, clusters, and institutions), CNA Ferrara ensures that SMEs are equipped to integrate digital solutions into their operations.
  The I4.0 services tested and promoted under BEST 4.0—such as innovation diagnostics, lean manufacturing, digital tools implementation, and capacity-building through research apprenticeships—are fully consistent with the S3 trajectories related to smart manufacturing,

sustainable maritime value chains, and digitalisation of services. The region's emphasis on ecosystem-based innovation is reinforced by CNA's role in guiding companies toward regional and EU funding schemes, thereby acting as a catalyst for the uptake of Industry 4.0 technologies in the Blue Economy.
The alignment is further supported by CNA Ferrara's collaboration with the Emilia-Romagna regional government and Clust-ER networks, facilitating policy-level dialogue and integration of

I4.0 services into future innovation programming. This synergy strengthens both territorial cohesion and cross-border cooperation with Croatian partners engaged in the BEST 4.0 project.

6.2.2 Project Area n. 2 : PP2 CNA ANCONA / Marche Region

- **Regional S3 Strategy Summary**

  The S3 specialization strategy adopted by the Marche Region aims to foster the development of a dynamic and attractive innovation ecosystem capable of drawing investments, talent, startups, and competitive value chains. Its goal is to ensure continuity and a systematic approach to industrial transition processes, providing a strong impetus for sustainable growth—economic, environmental, and social.
  The main objective is **to stimulate innovative processes and technological developments** thatstrengthen regional specializations and **support productive diversification**, driven by the skills and expertise present within the ecosystem. The strategy is designed to enhance the global competitiveness of the Region both nationally and internationally, strengthen the regional system's capacity to attract resources from national and European research and innovation programmes, and generate new opportunities for development and employment.

  The governance model adopted by the Region is highly participatory and involves the active and continuous engagement of all research and innovation stakeholders—universities, research institutions, companies, business associations, incubators and accelerators, financial institutions, and technology transfer centres. Through an entrepreneurial discovery process, this model enables the identification and monitoring of innovation needs and opportunities, as well as the definition of priority areas to target for sustainable economic growth.
  The implementation of the Marche S3 Strategy will involve actions not only aimed at improving the innovation content of traditional production sectors and entrepreneurial vocations, but also at **promoting new technological pathways and business models** capable of driving forward the development of the Region's territories.
  The identified specialisations and main productive components are: **housing, furniture and living environments; fashion and personal goods; mechanics and engineering; agri-food; health and wellbeing; products and services for culture and education; business services economy.** Across these seven productive areas, 50 innovation pathways have been identified.

The strategic approach focuses on **environmental sustainability** and climate change adaptation, the evolution toward an information society and **digital transformation**, life safety, as well as social integration and inclusion.

- **Main Blue Economy related sector**

  The S3 strategy of the Marche Region offers significant opportunities for the development of the nautical sector by aligning with key areas of specialization and innovation trajectories.

  Nautical industries intersect multiple value chains — mechanics and engineering, design and living environments, fashion and personal equipment — while contributing to strategic goals such as environmental sustainability and digital transformation.
  The sector is well-positioned to benefit from investments in advanced materials, green propulsion systems and Industry 4.0 technologies applied to shipbuilding and refitting.
  Furthermore, the integration of the nautical sector with tourism, cultural heritage, and service innovation opens new perspectives for the sustainable development of coastal areas.
  Through active participation in the regional innovation ecosystem — universities, research centres, technology clusters, incubators and Digital Innovation Hubs — the nautical sector can access resources and collaborations that enhance competitiveness and generate high-value employment. As such, the blue economy represents a strategic lever for promoting the twin transition—green and digital—envisioned by the Marche Smart Specialisation Strategy.

  The Blue economy in the Marche Region is strategically positioned across several priority areas identified by the Smart Specialisation Strategy, including mechanics and engineering, home and lifestyle design, fashion and personal equipment and advanced business services. These **intersections enable the development of high-value, cross-sectoral innovations**.

  The sector offers fertile ground for technological advancement through the adoption of lightweight and sustainable composite materials, integration of electric and hybrid propulsion systems, and implementation of digital tools for design, production and remote monitoring.
  These innovation trajectories directly support the region's objectives for industrial transition and competitiveness.
  Moreover, the nautical industry plays a **central role in the green transition**, contributing to lower environmental impact throughout the vessel lifecycle—from production to end-of-life disposal—while promoting circular economy models.
  At the same time, the sector supports the **development of sustainable coastal and maritime tourism**, fostering new service models that combine technology, culture, and environmental awareness. The promotion of maritime heritage and blue economy initiatives aligns with broader goals of social inclusion, territorial resilience and the valorisation of local know-how.

- **Main Innovation connected to our project**
  The BEST4.0 project is closely aligned with the strategic priorities of the Marche Region's Smart Specialisation Strategy (S3), particularly in its **support for digital transformation, industrial innovation and cross-border collaboration**. By promoting the adoption of Industry 4.0 technologies — such as automation, data-driven design and smart manufacturing — BEST4.0 directly contributes to the innovation trajectories identified in the S3 across key sectors including advanced manufacturing, mechanics and the nautical industry. The project's emphasis on capacity-building, knowledge exchange and SME support **reinforces the regional objective of strengthening innovation ecosystems and enhancing the competitiveness of local value chains**. Moreover, BEST4.0 serves as a platform for entrepreneurial discovery, fostering the emergence of new business models and stimulating interregional cooperation in areas of shared strategic interest. As such, the project acts as a catalyst for **achieving the twin transition—green and digital**—envisioned by the Marche S3, while amplifying its impact through transnational synergies and innovation networks.

- **Contribution to the Cross-Border I4.0 Service Ecosystem**

The Marche Region's Smart Specialisation Strategy (S3) focuses on strengthening innovation ecosystems and supporting industrial transition across traditional and emerging sectors. The Blue Economy is increasingly recognised within the region's innovation priorities, particularly in relation to shipbuilding, sustainable mobility, digital tourism, and smart coastal development.
CNA Ancona, through its regional Digital Innovation Hub "Marche Innovation Hub – MIH", supports SMEs with a structured catalogue of services aligned with these strategic directions. These include services for business improvement (network creation, internationalisation, digital planning), I4.0 applications (product/process analysis, digital innovation consultancy, technology transfer), and I4.0 capacity building (training pathways, internships, high-level skills integration).

This offer is directly aligned with the regional goals of boosting digitalisation in the shipbuilding and coastal tourism sectors, especially where SMEs require tailored support for adopting I4.0 technologies. The emphasis on business diagnostics, IP protection, and technology scouting addresses critical barriers identified in the S3 for SME innovation uptake.
CNA Ancona's strong relationship with local marinas, the Port Authority of the Central Adriatic Sea, and SMEs across the shipbuilding value chain ensures the relevance and replicability of its services. Furthermore, the integration of MIH into the EDIH4Marche network enhances cross-regional service accessibility and positions the I4.0 catalogue as a key tool to implement the S3 vision through public-private cooperation, capacity building, and open innovation in the Blue Economy.

6.2.3 Project Area n.3 : PP3 CETMA

- **Regional S3 Strategy Summary**

The Apulia Region's Smart Specialisation Strategy ("Smart Puglia 2030") builds upon the original SmartPuglia2020 framework, which prioritized sustainable manufacturing, human and environmental health, and digital, creative, and inclusive communities. Updated under the 2021–27 programming period, the strategy continues to advance flexible and place-based innovation ecosystems, emphasizing digital transformation and integration of industrial and service. Moreover, the Blue Economy is explicitly reinforced within S3 priorities, particularly through regional mappings and investments in sustainable aquaculture, maritime tourism, ports and transport infrastructure, marine biotechnology, and energy innovations.

The Smart Specialisation Strategy (S3) of the Apulia Region (Puglia) identifies several sectors that are closely linked to the Blue Economy and where innovation policies are actively promoted. These include **Energy and Environment**, with strong potential for marine renewable energies such as offshore wind and wave energy, and a focus on the sustainable management of marine ecosystems. The **Agro-food** sector connects through sustainable fishing and aquaculture, where innovation in traceability and eco-friendly practices is encouraged. **Advanced Manufacturing** plays a key role in the production of ships, maritime equipment, and technologies for aquaculture and offshore energy applications.

In addition, the S3 strategy places a strong emphasis on the pillar of **Digital, Creative, and Inclusive Communities**, which supports the growth of **Creative and Cultural Industries (CCI)** and promotes **smart, immersive, and experiential tourism** connected to the regional identity and maritime culture. This trajectory is particularly relevant for the Blue Economy in Apulia, where coastal and maritime tourism are key sectors. The integration of **digital storytelling**, **VR/AR technologies**, and innovative event formats is actively encouraged to enhance the tourist offer and the valorisation of maritime heritage and natural resources

Through this integrated vision, the Apulia Region fosters an innovation ecosystem that combines advanced and sustainable technologies with creative industries, supporting a diversified and resilient Blue Economy that contributes to both economic growth and cultural and environmental sustainability.

- **Main Blue Economy related sector**

In the Puglia region, the most significant Blue Economy sectors are:

- **Marine renewable energy**, particularly offshore wind and marine current energy;
- **Sustainable fishing and aquaculture**, with a strong regional tradition in fish and seafood production and increasing adoption of innovative technologies;
- **Shipbuilding and advanced maritime equipment manufacturing**, supporting both commercial and recreational marine activities;
- **Coastal and maritime tourism**, an essential sector for the region given its 800 km of coastline and vibrant network of ports, including key hubs in Bari and Brindisi;

- **Creative and Cultural Industries (CCI)** linked to maritime heritage and coastal tourism, leveraging digital innovation and immersive experiences.
- **Main Innovation connected to our project**

- Within this framework, the contribution of PP3-CETMA to the BEST4.0 project focuses on facilitating the digital transformation of Blue Economy SMEs by integrating Industry 4.0 solutions.

The innovations promoted include:

- **Advanced materials engineering** (for shipbuilding and sport equipment);
- **Automation and robotics** (for manufacturing processes and aquaculture);
- **Digital twin and immersive technologies** (VR/AR for training, tourism, and maintenance);
- **Smart environmental monitoring** and IoT solutions to support sustainable aquaculture and marine ecosystem protection;
- **Capacity building and support for highly innovative SMEs**, many of which are start-ups operating in the Blue Economy;
- **Creative technology applications** for enhancing maritime tourism, cultural events, and visitor experiences, in synergy with the S3 creative industries strategy.

CETMA leverages its multidisciplinary expertise and an extensive network of regional stakeholders to support this innovation ecosystem, including collaboration with the **Consorzio Nautico Puglia**, the **FAROS Blue Economy Accelerator**, and local enterprises engaged through the **SNIM - Salone Nautico di Puglia** and **NautiGO – Salone Nautico Internazionale del Salento**. These networks ensure that I4.0 services are tailored to the evolving needs of Blue Economy SMEs across multiple value chains and contribute to the reinforcement of regional S3 priorities.

- **Contribution to the Cross-Border I4.0 Service Ecosystem**

  The Apulia Region's Smart Specialisation Strategy (S3) strongly focuses on Blue Economy sectors such as sustainable shipbuilding, advanced materials, and immersive digital technologies for tourism and training. CETMA's contribution to BEST 4.0 is deeply aligned with these trajectories, offering a portfolio of Industry 4.0 services that leverage immersive design, ergonomic validation, and digital product development.

  In particular, CETMA developed and tested services including:

  - **Immersive Virtual Reality (VR) and Augmented Reality (AR)** for the co-design and evaluation of ship interiors and coastal infrastructure;
  - **Digital ergonomics simulations**, using virtual mannequins and motion capture for safety, comfort, and space optimisation;
  - **Material characterisation and smart composite testing** applicable to marine components and sustainable shipbuilding;

- **CAD-based parametric modeling** integrated with virtual testing tools for prototyping and system configuration.

These services respond directly to the Apulian S3 goals of fostering industrial innovation, sustainability, and digital transformation in maritime and tourism-related sectors. Moreover, their strong focus on **human-centered design and simulated validation environments** supports regional efforts to combine technological development with social and environmental well-being. Thanks to CETMA's active role in the regional innovation ecosystem, these services are already positioned to contribute to Apulia's policy priorities. Their integration into the regional DIH network and uptake by local SMEs enhance the potential for long-term sustainability and cross-sector application. CETMA's work within BEST 4.0 reinforces the Region's ambition to become a leading innovation hub in the Adriatic maritime area.

6.2.4 Project Area n.4 : PP4 AREA SCIENCE PARK

- **Regional S3 Strategy Summary**

The **Smart Specialisation Strategy of Friuli Venezia Giulia 2021–2027** (S3 or also S4-Sustainable Smart Specialisation Strategy) is a fundamental tool for guiding regional development through innovation. The strategy aims to transform the productive sector, making it **more innovative, resilient and sustainable** from an economic, environmental and social standpoint *("A transformed productive sector: more innovative, resilient and sustainable, from both an environmental and social point of view").* This phrase is not a simple programmatic vision, but rather the response to a series of systemic weaknesses in the territory, which emerged from an in-depth context analysis based on a study commissioned by the Regional Administration to the **Organisation for Economic Co-operation and Development (OECD)**.

The OECD study, based on a mixed approach of surveys and focus groups, highlighted a **"mismatch between innovation demand and supply"** and several **"bottlenecks".** In fact, it emerged that regional companies, particularly SMEs, make limited use of the services offered by clusters, science and technology parks (STPs) and university technology transfer offices (TTOs). For example, although 48% of the surveyed companies admit they need external support for digitalization, only 28% actually access such support, and of these only a few turn to institutional actors within the innovation system. **The S3 2021–2027, therefore, positions itself as an integrated system aimed at bridging this mismatch and building a strong connective tissue between research and business**.

The Friuli Venezia Giulia Region has identified five areas of smart specialisation:

- Maritime Technologies – Sustainable Waterborne Mobility and its land connections.
- Energy transition, circular economy, and environmental sustainability.
- Smart Manufacturing and Sustainable Development of Made in Italy supply chains.
- Health, Quality of Life, Agri-food, and Bioeconomy.
- Cultural heritage, design, creative industries, tourism.

In particular, Maritime Technologies constitute a strategic axis, given the economic relevance of the sector, its industrial tradition and geographical location. Investing in this area makes it possible to act on **one of the main drivers of growth and exports for Friuli Venezia Giulia**, strengthening the international competitiveness of the territory. Furthermore, this Area of Specialisation shows **great**

coherence with macro-regional strategies, such as EUSAIR and with European thematic platforms. This alignment signals a clear strategic orientation towards internationalisation and cross-border cooperation, positioning Friuli Venezia Giulia as a maritime innovation hub in the European context.

The Area of Specialisation dedicated to Maritime Technologies is structured into three **Development Trajectories**, defined through the "entrepreneurial discovery" process, which actively involved stakeholders from the sector. Specifically:

1. **Green Mobility:** focuses on technologies, systems and solutions for the environmental sustainability of ships and ports. This includes areas such as energy efficiency in production processes, the development of technologies for electric boating (with regional marinas and tourist ports conceived as energy hubs), and sustainable seabed maintenance. **This line of action directly responds to European regulatory guidelines, such as the "Fit for 55" package**, as well as the growing market demand for low-impact environmental solutions.
2. **Smart Mobility:** a trajectory dedicated to digital technologies for ships, shipyards, ports and their land connections. Key areas include Data-driven Life Cycle Design, the development of Digital Twins to optimize the management of ports, inland ports and logistics networks, as well as the creation of sharing solutions for nautical tourism. **This trajectory represents a fundamental “strategic anchor” for BEST4.0, as it generates the "demand" for the Industry 4.0 digital solutions that the project offers.**
3. **Sea Made in FVG:** aims to strengthen the competitiveness and resilience of the entire region through systemic solutions. This trajectory includes the development of an **aggregated service platform to support SMEs**, research on sustainable materials and systems for construction and outfitting, as well as the spread of home automation and on-board automation.

Together, these Development Trajectories represent a **precise and integrated response to the "twin transition”, green and digital,** providing a clear framework for investments in innovation and guiding the actions of the Regional Administration, operators/companies and all stakeholders in the Blue Economy.

- **Main Blue Economy related sector**

The Blue Economy in Friuli Venezia Giulia has a significantly higher impact than the Italian average. According to the ***"12th National Report on the Maritime Economy"*** (Unioncamere, July 2024), the **value added generated by the Blue Economy amounts to €2.7 billion, which is equal to 7.2% of the region's total, compared to the Italian average of 3.7%** (€64.5 billion in value added).
In the national ranking for the incidence of the maritime economy's value added on the total economy, Friuli Venezia Giulia is the second region after Liguria. The high incidence of value added

is distributed by province as follows: €1.6 billion in Trieste (56.5%), €593.9 million in Udine (21.5%), €516.2 million in Gorizia (18.7%) and €91.3 million in Pordenone (3.3%).
It is worth noting that **shipbuilding contributes to almost 40% of the sector's Italian exports of this specific sector.**

The added value is generated by the regional "key sectors" of the Blue Economy, specifically:

- **Shipbuilding**, which is one of the strongest and most innovative sectors, including the production of yachts, on-board equipment and ship dismantling.
- **Fishing industry**, covering fishing, processing and sale of the catch.
- **Maritime transport of goods and passengers**, supported by a significant logistics and insurance network.
- **Hospitality and catering services** linked to coastal and cruise tourism.
- **Sports, tourism and recreational activities** related to the sea.
- **Research and development**, particularly in marine biotechnology and environmental regulation.

According to the study ***"The Blue Economy in Friuli Venezia Giulia"*** by the Pordenone-Udine Chamber of Commerce (2024), **in 2023 Blue Economy companies accounted for 4.1% of all companies in the region, compared to the Italian average of 3.8%.** In Italy, 227.975 Blue Economy companies were registered in 2023, of which 4.030 located in Friuli Venezia Giulia (1.849 in Trieste, 1.281 in Udine, 785 in Gorizia and 115 in Pordenone). Regarding employment in the sector, the **region accounts for 5.2% of total employment, compared to a national average of 4.1%** (8th place in Italy).

Structure of the Blue Economy in Friuli Venezia Giulia

Sector	Added Value (M€)	Added Value (%)	Employees
Cargo and passenger handling	858,6	31,80%	N.D.
Shipbuilding	729	27,00%	N.D.
Accomodation and catering	480,6	17,80%	N.D.
Research and environmental protection activities	459	17,00%	N.D.
Fishing industry	116,1	4,30%	N.D.
Sports and recreational activities	56,7	2,10%	N.D.
Total Blue Economy FVG	**2.700**	**100%**	**28.792**

Source: "XII National Report on the Blue Economy" - Unioncamere, July 2024

- **Main Innovation connected to our project**

BEST4.0 is a concrete response to the operational challenges that SMEs in the Blue Economy face in terms of digitalization and innovation, fitting perfectly within the Trajectories of the regional S3. The integration of research, business, and public governance represents a virtuous example of collaboration, **including cross-border cooperation.**
The project's activities are a direct response to the **"innovation bottlenecks"** identified by the OECD in its study, particularly the difficulty SMEs have in accessing qualified support services. Fundamentally, **BEST4.0 acts as a "de-risking" mechanism for SMEs**, as investing in Industry 4.0 technologies is costly and risky for a small business. By offering services such as "Digital Demonstration & Testing," according to the model successfully developed by **IP4FVG, the Digital Innovation Hub of Friuli Venezia Giulia** coordinated by Area Science Park, **the project drastically lowers the barrier to entry for innovation.** This allows SMEs to evaluate and experiment with new technologies in a controlled and subsidized environment.
In this way, BEST4.0 does not just provide information but **creates a suitable environment for experimentation, which is the most effective way to convince an SME to adopt a new and potentially disruptive technology.**
Furthermore, in the context of the project, Area Science Park contributed to the development of a **questionnaire**, with its related guidelines, used by the partners' auditors to assess Blue Economy SMEs. **This provided an initial orientation on their level of adaptation concerning the nine "pillars" of Industry 4.0 selected by BEST4.0, as well as on the necessary interventions**. There was also a section dedicated to measuring the SMEs' degree of awareness regarding ESG (Environmental, Social, and Governance) criteria.
The questionnaire was followed by the development, also carried out jointly with the other partners, including the Lead Partner, of **a specific TML - Technology Maturity Level Index**. This index consists of a set of indicators aimed at evaluating the capabilities of SMEs and their degree of technological readiness and maturity, allowing the drafting of **specialized reports** for each audited company.
In conclusion, the project is not an isolated initiative but a systemic tool to strengthen the resilience of the maritime economy, reduce the digital divide and reinforce innovation networks between the two shores of the Adriatic.

- **Contribution to the Cross-Border I4.0 Service Ecosystem**

The Friuli Venezia Giulia Region's Smart Specialisation Strategy (S3) identifies digital transformation, advanced manufacturing, energy and environmental sustainability as key strategic trajectories, all of which intersect with the Blue Economy—particularly through maritime logistics, sustainable technologies, and marine energy systems. Area Science Park's role as coordinator of the **IP4FVG European Digital Innovation Hub (EDIH)** further anchors its contribution to the regional S3, with a focus on promoting Artificial Intelligence (AI), High Performance Computing (HPC), and Cybersecurity. Within the BEST 4.0 project, Area Science Park delivers a highly relevant portfolio of I4.0 services, structured across three main digital Living Labs:

- The **Data Analytics & Artificial Intelligence Lab**, supporting AI-powered quality inspection, predictive maintenance, and process optimization;
- The **Data Optimization & Simulation Lab**, offering digital twin simulations for logistics, energy systems, and maintenance using FEM and AR technologies;
- The **IoT Living Lab**, enabling real-time monitoring and control, edge computing, and smart factory deployments.

These services directly address the regional S3 ambitions for industrial innovation and environmental sustainability, providing advanced technological tools for SMEs in the Blue Economy. Use cases such as predictive maintenance for marine equipment, energy efficiency simulations for port infrastructure, and data-driven aquaculture monitoring represent tangible applications of these technologies in line with regional priorities.

Moreover, Area Science Park's **ORFEO Data Center**, equipped for AI and HPC applications, contributes to regional capacity-building for large-scale data processing and digital transition. Its services are open to SMEs and research institutions, aligning with the region's open innovation model.

In the context of BEST 4.0, Area Science Park has also co-developed assessment tools such as the **Technology Maturity Level (TML) Index**, contributing to S3 implementation by providing evidence-based insights into SME digital readiness. Overall, the alignment between Area Science Park's services and the FVG S3 is robust, enabling the integration of I4.0 solutions into regional innovation strategies, and reinforcing cross-border cooperation through the Digital Marine Hub and related policy frameworks.

6.2.5 Project Area n.5 : PP5 CCE

- **Regional S3 Strategy Summary**

  The Smart Specialisation Strategy (S3) of Split-Dalmatia County is based on the national S3 strategy and regional development priorities, with a focus on sustainable development, digital transformation, and the innovation potential of the blue economy. The county leverages its geographical position, rich maritime tradition, and natural resources to foster smart and inclusive economic growth, while enhancing the resilience and competitiveness of local enterprises. Special emphasis is placed on developing innovation ecosystems through collaboration between research institutions, entrepreneurs, educational institutions, and the public sector.

  The strategy, defined within the Development Plan of Split-Dalmatia County for the period 2022–2027, aligns with the goals of the European Green Deal and national industrial transition policies. It is directed towards investments in technologically advanced, environmentally sustainable, and socially responsible solutions that support the transformation of key sectors of the regional economy, particularly fisheries and fish processing, shipbuilding, information technology, tourism, and maritime transport and logistics.

  The implementation of the strategy is based on networking key stakeholders, including the University of Split, county institutions, development agencies, technology parks, and digital innovation hubs. This collaboration enables entrepreneurs to access knowledge, infrastructure, and support necessary for applying advanced technologies and digital solutions. In this way, the

Smart Specialisation Strategy of Split-Dalmatia County aims to create a dynamic, sustainable, and technologically advanced economy that builds on local strengths while being strongly integrated into the European innovation space.

- **Main Blue Economy related sector**
  The blue economy represents one of the fundamental pillars of development in Split-Dalmatia County, building on a rich maritime tradition, a highly indented coastline, and a strong base of marine-related economic activities. Key sectors include fisheries and fish processing, shipbuilding, information technology, tourism, and maritime transport and logistics.
  The small shipbuilding segment is increasingly adopting advanced technologies, while tourism – as the main source of income and employment in the county – is undergoing a significant digital transformation. Local IT companies actively support this transition by developing innovative digital solutions for tourism and blue services, including mobile applications for booking and fleet management, systems for optimizing vessel operations, virtual guides, and digital tools for destination promotion. These developments strengthen the integration between the ICT sector and tourism, enhancing the innovation capacity of the blue economy.
  Fisheries, fish processing, and aquaculture are also advancing through the application of smart technologies, improving efficiency, environmental sustainability, and traceability.
  The Port of Split, as the central node for maritime transport and logistics, is undergoing digitalization processes aimed at improving operational flow, safety, and energy efficiency.
  The structure and orientation of the blue economy in Split-Dalmatia County offer strong potential for the adoption of digital and green innovations, supported by cooperation with academic and development institutions. This integrated and forward-looking approach provides a solid foundation for the implementation of initiatives such as BEST4.0 and reinforces the County's role as a frontrunner in building a smart, sustainable, and competitive blue economy – with strong potential for knowledge exchange and interregional cooperation.

- **Main Innovation connected to our project**
  The BEST4.0 project is fully aligned with national and regional strategic priorities defined in the Smart Specialisation Strategy, with a particular emphasis on digital transformation, industrial modernisation, and cross-border cooperation. By fostering the adoption of Industry 4.0 technologies — including automation, data-driven production, and smart systems — the project directly contributes to innovation pathways in Split-Dalmatia County across key sectors such as include fisheries and fish processing, shipbuilding, information technology, tourism, and maritime transport and logistics.
  BEST4.0 promotes capacity building, knowledge transfer, and targeted support for SMEs, thereby reinforcing the regional innovation ecosystem and increasing the resilience and competitiveness of local value chains within a cross-border framework.

Furthermore, the project serves as a platform for entrepreneurial discovery and the development of innovative business models, enhancing interregional and transnational cooperation in areas of shared strategic interest. In doing so, It contributes to the dual transition towards a digital and sustainable economy, simultaneously reinforcing its impact through active integration into European innovation ecosystems and cross-border cooperation structures.

- **Contribution to the Cross-Border I4.0 Service Ecosystem**

The Croatian Chamber of Economy (CCE) plays a strategic role in supporting the digital transition of SMEs in Croatia and acts as a national-level facilitator for innovation. Its service portfolio under BEST 4.0 includes digital maturity assessments, capacity building programs, project development support, and access to the Digital Chamber platform.
CCE's offerings are well aligned with the regional S3 priorities of Šibenik-Knin County and other coastal regions, where aquaculture, sustainable fisheries, food processing, and marine technologies are recognized as key development areas. The focus on digitalisation, automation, and smart systems directly supports the regional aim of enhancing competitiveness in the Blue Economy sector.
Through workshops, business diagnostics, B2B matchmaking, and funding advisory services, CCE fosters integration between technology providers and traditional Blue Economy actors such as fish farms, seafood processors, and port-based logistics operators. These interventions correspond closely to S3 objectives around improving productivity and innovation capacity in marine-related industries.
Moreover, the use of the Digital Chamber platform ensures scalable and inclusive access to I4.0 services and data tools, supporting cross-sector digital adoption across Croatia. By embedding these tools in SME support systems, CCE actively contributes to aligning national and regional innovation policies with the goals of BEST 4.0, creating a fertile ground for policy coherence and long-term sustainability.

6.2.6 Project Area n.6 : PP6 IDA

- **Regional S3 Strategy Summary**

The Smart Specialisation Strategy (S3) of Istria County (2021-2027) defines a development framework focused on green and digital transitions, smart use of natural resources, and value chain modernisation. Within this strategy, the Blue Economy is explicitly prioritised through Measure 3.4.5, which supports:

- Development of sustainable aquaculture and expansion of marine farming zones;
- Modernisation of port and fishery infrastructure;
- Promotion of value-added processing in marine food chains;
- Technological innovation for sustainable marine resource use.

These priorities align with the EU Blue Economy Agenda, Green Deal objectives, and EUSAIR Pillar 1 - Blue Growth, ensuring full policy coherence at regional, national, and EU levels.
The strategy promotes quadruple helix cooperation and leverages Istria's natural maritime assets - 539 km of coastline, historic ports, and marine biodiversity - to create a resilient innovation

ecosystem that connects traditional sectors (fisheries, tourism, shipbuilding) with new growth niches (blue tech, smart tourism, sustainable aquaculture).

- **Main Blue Economy related sector**

The most relevant Blue Economy sectors in Istria are:

- Marine and coastal tourism, representing Istria's leading economic sector with over 30 million annual overnight stays and a dense network of Blue Flag marinas (e.g. ACI Pula, Marina Veruda);
- Fisheries and aquaculture, including established shellfish farming in Lim Bay and strategic plans to expand low-impact mariculture;
- Shipbuilding and marine engineering, centred around Tehnomont Shipyard Pula — producer of patrol boats and work vessels for EU markets;
- Port and maritime infrastructure, supported by functional small ports (Pula, Rovinj, Raša) and local harbormaster offices;
- Maritime culture and coastal valorisation, including initiatives that link gastronomy, seafaring heritage and sustainable tourism (e.g. CROFISH fair, KeyQ+ heritage routes).
  These sectors form a dynamic platform for blue innovation, SME development, and circular blue growth, anchored in territorial assets and strategic investments.

- **Main Innovation connected to our project**

Within the BEST4.0 project, IDA contributes to the digital transition of Blue Economy SMEs in Istria by combining service provision with participation in testing emerging technologies. As part of the project's cross-border Industry 4.0 catalogue, IDA offers advisory support on funding access, digital marketing, entrepreneurship training, business model development in cooperation with research institutions, and mentoring through incubators.
In addition to these services, IDA is involved in testing VR/AR tools as part of the project's broader pilot activities, with a focus on assessing their applicability in SME and regional development contexts. This engagement supports knowledge transfer, innovation uptake, and the practical evaluation of immersive technologies in relation to blue economy opportunities.
Through these actions, IDA reinforces its role as a facilitator of innovation and capacity building in the region, in alignment with the Smart Specialisation Strategy of Istria County and the BEST4.0 objectives for cross-border cooperation, digitalisation, and SME competitiveness.

- **Contribution to the Cross-Border I4.0 Service Ecosystem**

The Smart Specialisation Strategy of Istria identifies key priorities that closely intersect with Blue Economy innovation, including sustainable tourism, ICT, food production and processing, and energy efficiency. Within this framework, marine-related sectors such as fisheries, aquaculture, shipbuilding, and smart coastal tourism represent strategic areas for investment and development.

As a regional development agency, IDA supports Blue Economy SMEs with a wide portfolio of business support services that align with the regional S3 and BEST 4.0 objectives. In the project, IDA's contribution focused on promoting digital transformation by facilitating access to cross-border I4.0

services, identifying SME needs through TML assessment, and promoting capacity building in areas such as digital maturity, innovation planning, and project development.
The alignment with regional S3 priorities is particularly evident in the following BEST 4.0 service categories:

- **Business improvement services**, such as support in digital strategy development and access to EU funding for innovation, help SMEs in fisheries and aquaculture improve competitiveness and market positioning;
- **Capacity building services**, including digital transformation training and mentoring, directly address the S3 goals of increasing digital readiness across sectors;
- **Technology transfer facilitation**, promoted by IDA through the dissemination of BEST 4.0 tools and collaboration with other DIHs, supports Istria's objective to enhance regional innovation ecosystems and cross-border cooperation.

Through its ecosystem coordination role, IDA enables Blue Economy SMEs to connect with DIHs and benefit from structured service offerings. This supports the digitalisation and innovation trajectories defined by the S3 and contributes to building a more resilient and technologically integrated regional maritime economy.

6.2.7 Project Area n.7: PP7 DIH – DIH Agrifood Croatia (Šibenik-Knin and Zadar Counties)

- **Regional S3 Strategy Summary**

Šibenik-Knin and Zadar counties are core territories of Dalmatia within Adriatic Croatia, recognized for their abundant natural resources, maritime heritage, and institutional strengths in tourism, fisheries, marine research, and sustainable innovation. The Smart Specialisation Strategy (S3) of Croatia (2021–2027) is implemented regionally through the Adriatic and Continental macro-regions, with Šibenik-Knin and Zadar counties positioned as strategic areas for S3-driven Blue Economy development.
This Cross-Border Orientation Plan aligns with Croatia's S3, the EU Blue Economy Strategy, and the Green Deal, promoting innovation-led and sustainable growth through enhanced cross-border cooperation. The aim is to establish Dalmatia—and specifically Šibenik-Knin and Zadar counties—as

a leading hub for Blue Economy innovation in the Adriatic, leveraging smart specialisation, maritime technology, and strong partnerships across the Adriatic-Ionian macroregion.
Key S3 priorities for this area include smart coastal tourism, sustainable aquaculture, marine biotechnology, port digitalisation, marine renewable energy, and circular economy in the maritime sector. Implementation is supported by local institutions such as the Šibenik-Knin Development Agency and the University of Zadar, in collaboration with DIH Agrifood Croatia and other innovation actors.

- **Main Blue Economy Related Sectors**

In Šibenik-Knin and Zadar counties, the following Blue Economy sectors are most relevant to both the national S3 and regional development plans, and are the primary focus of DIH Agrifood Croatia within the BEST4.0 project:

- **Sustainable Aquaculture and Fisheries:** Implementation of IoT-based environmental monitoring, AI-driven production optimisation, and traceability tools in shellfish and fish farming.
- **Marine Biotechnology:** Valorisation of algae and shellfish through bio-based innovations in nutraceuticals, cosmetics, and biomaterials.
- **Smart and Sustainable Coastal Tourism:** Development of digital tourism services, eco-tourism concepts, and heritage preservation linked to maritime identity.
- **Green Maritime Transport and Smart Ports:** Use of hybrid-electric vessels for island connectivity, port digitalisation via IoT and blockchain, and pilot actions for green maritime corridors.
- **Circular Economy in the Maritime Sector:** Sustainable shipbuilding, marine waste reuse and recycling, and innovative upcycling solutions through creative industries.

These sectors reflect Dalmatia's comparative advantages and are central to the digital transformation and sustainable innovation supported by DIH Agrifood Croatia through BEST4.0.

- **Main Innovation Connected to Our Project**

As a BEST4.0 project partner, DIH Agrifood Croatia is uniquely positioned to deliver targeted innovation in the Blue Economy of Šibenik-Knin and Zadar counties, in line with S3 priorities and the project's regional division of roles:

- **Deployment of Industry 4.0 Technologies:** Integration of IoT, machine learning, automation, and blockchain in aquaculture and fisheries to enhance operational efficiency and environmental resilience.
- **Operation of the Blue Living Lab:** A real-world testing facility at a mussel and oyster farm, enabling SMEs to pilot digital solutions for water quality monitoring, smart feeding systems, and traceability.
- **Support for Marine Bioeconomy:** Facilitating the adoption of innovative processes for high-value marine bioproducts, circular food chains, and waste valorisation.

- **Capacity Building and Skills Development:** Organisation of workshops, mentoring, and technical training to equip SMEs and entrepreneurs with digital skills for transformation.
- **Cross-Border Collaboration and Innovation Ecosystem Building:** Linking Croatian SMEs with Italian and other Adriatic partners, enabling joint pilots, mutual learning, and alignment with EU policy frameworks such as Horizon Europe and the EDIH network.

DIH Agrifood Croatia's activities are concentrated in Šibenik-Knin and Zadar counties, ensuring that the BEST4.0 project generates tangible impact in these regions, while other project partners address complementary Blue Economy sectors and territories elsewhere in the Adriatic. This regional focus strengthens the Blue Economy, accelerates smart specialisation, and supports the broader goals of Croatia's national S3 and regional development plans

- **Contribution to the Cross-Border I4.0 Service Ecosystem**

The Smart Specialisation Strategy (S3) for the Croatian Adriatic macro-region, which includes Šibenik-Knin and Zadar Counties, identifies several key innovation domains within the Blue Economy, including sustainable aquaculture, marine biotechnology, smart coastal tourism, and green maritime transport. DIH Agrifood Croatia's portfolio of I4.0 services under BEST 4.0 is well aligned with these regional priorities, directly supporting the twin transition—digital and green—envisioned by the S3.

Notably, the **Blue Living Lab**, operated by DIH Agrifood Croatia, serves as a flagship infrastructure for piloting smart aquaculture innovations. Services such as **AI-powered environmental monitoring, IoT-based sensor systems, and blockchain-enabled traceability** directly address the region's priorities in eco-sustainable fish farming and food safety. These are further supported by capacity-building services including **hands-on workshops, training on digital tools, and business mentoring**, designed to enhance SME readiness for technology adoption.

The "Test Before Invest" methodology implemented through the Blue Living Lab allows SMEs to validate I4.0 applications before large-scale deployment, thereby reducing risks and improving the cost-effectiveness of digital transition strategies. These services directly map onto S3 trajectories focused on sustainable production, innovation in marine biotechnology, and digitalisation of value chains.

Furthermore, by integrating **logistics optimisation services, data analytics, and industry events for knowledge sharing**, DIH Agrifood Croatia reinforces regional S3 goals of improving connectivity, fostering open innovation, and building cross-sector collaboration.

Overall, the I4.0 services implemented by DIH Agrifood Croatia through BEST 4.0 are fully consistent with the strategic vision of the Croatian S3. They contribute not only to technological advancement but also to system-wide capacity-building across the maritime innovation ecosystem of Dalmatia.

6.2.8 Project Area n.8 : PP8 PFRI

- **Regional S3 Strategy Summary**

  Primorsko-goranska County (PGC) embraces a forward-looking Smart Specialisation Strategy (S3) aimed at cultivating an open, resilient, and innovation-driven economy rooted in its unique coastal, maritime, and mountainous identity. The regional strategy supports the twin transition—green and digital—by stimulating cross-sectoral innovation, industrial transformation, and sustainable development across urban and rural territories.

  The S3 policy in PGC seeks to strengthen regional specialisations through technological upgrading, value chain diversification, and the promotion of knowledge-intensive services. Its objective is to attract talent, investments, and entrepreneurial initiatives while reinforcing the research and innovation ecosystem at the regional and transnational levels.

  The governance model is collaborative and inclusive, involving universities (such as the University of Rijeka), research centres, technology parks, industry clusters, SMEs, and public institutions. The Entrepreneurial Discovery Process ensures continuous dialogue with stakeholders, enabling adaptive policymaking and prioritisation of emerging innovation needs.

  Specialisation areas include blue economy, health and active ageing, smart mobility and logistics, sustainable tourism, and green technologies. The regional strategy integrates environmental resilience, digitalisation, and social cohesion as key horizontal principles.

- **Main Blue Economy related sector**

  As a coastal region with a strong maritime tradition, Primorsko-goranska County positions the blue economy as a pillar of its smart specialisation. The sector intersects with advanced engineering, shipbuilding and refitting, renewable energy, maritime logistics, and sustainable tourism.

  The region promotes innovation in lightweight materials, green ship technologies, hybrid propulsion systems, and digital tools for ship design and monitoring. Close collaboration with maritime faculties, innovation hubs, and the local shipbuilding industry facilitates knowledge transfer and technological experimentation.

  The blue economy also underpins the development of new services in eco-tourism, maritime heritage valorisation, and coastal resilience. By linking cultural and natural assets with smart and sustainable technologies, the region creates inclusive growth opportunities and diversifies its coastal economy.

- **Main Innovation connected to our project**
  The BEST4.0 project aligns closely with PGC's S3 priorities by fostering digital transformation, maritime innovation, and cross-regional collaboration. Through its emphasis on Industry 4.0 technologies — including automation, VR/AR simulation, and smart manufacturing — the project contributes to upgrading traditional maritime industries and enhancing training capacity in high-value sectors.
  BEST4.0 serves as a catalyst for workforce upskilling, SME competitiveness, and regional-global value chain integration. Its support for the green and digital transitions complements PGC's vision of a climate-smart, innovation-led economy and reinforces its position within the Adriatic-Ionian and wider EU innovation ecosystems.

- **Contribution to the Cross-Border I4.0 Service Ecosystem**

The Smart Specialisation Strategy (S3) of Primorje-Gorski Kotar County (PGC) emphasises the Blue Economy as a strategic pillar for sustainable and innovation-driven growth. Key regional priorities include smart maritime transport, digital port logistics, green shipbuilding, and marine technology. The S3 also places strong emphasis on human capital development, simulation-based training, and digitalisation of maritime education.
Within the BEST 4.0 framework, PFRI contributed advanced I4.0 services focused on **immersive learning, virtual and augmented reality (VR/AR) environments, simulation labs, and digital tools for smart shipping**. The Engine Room VR Lab (EVR Lab), Full Mission Bridge Simulator, and AI-supported maritime training platforms are among the most prominent assets offered. These services directly address regional needs for upskilling maritime professionals and modernising education systems in line with green and digital transition goals.
The alignment between PFRI's services and regional S3 trajectories is particularly evident in the areas of **sustainable ship operations**, **smart logistics**, and **competency-based education**. For instance, PFRI's simulation-based training supports energy efficiency, environmental compliance, and safety at sea, fully consistent with the S3 emphasis on eco-innovation and resilience.
Additionally, the close integration of PFRI's facilities with regional tech hubs (e.g. SmartRI and Technology Park Rijeka) enables continuous transfer of knowledge and technology to SMEs, aligning well with the region's entrepreneurial discovery process. PFRI's contributions within BEST 4.0 enhance regional policy implementation by offering scalable, replicable I4.0 solutions that foster maritime digitalisation and cross-border cooperation.

6.3. Cross-Border Alignment and Strategic Convergence

A central objective of the BEST 4.0 project is to promote convergence and policy coherence across regional innovation ecosystems in the Italy–Croatia cooperation area. This paragraph presents a mapping of shared priorities and emerging synergies among the Smart Specialisation Strategies (S3) of partner regions, with reference to the Blue Economy sector.

Shared Areas of Focus Identified Across S3 Strategies:

- **Sustainable Aquaculture and Traceability**
  Most participating regions, including Apulia, Marche, Istria, and Split-Dalmatia, identify aquaculture and fish traceability as key innovation fields. Services from the BEST 4.0 catalogue—such as IoT for environmental monitoring, AR/VR for aquaculture training, and AI for data analysis—are fully aligned with these priorities.
- **Shipbuilding and Marine Technologie**s
  Emilia-Romagna, Friuli Venezia Giulia, and Rijeka emphasize the development of digital shipbuilding, smart marinas, and sustainable refitting. BEST 4.0 supports this through services for digital prototyping, robotics, simulation, and additive manufacturing.
- **Smart Coastal Tourism**
  Coastal tourism innovation—including experiential design, immersive environments, and digital visitor engagement—is a shared priority across regions like Apulia, Marche, and Split-Dalmatia. The integration of services such as VR/AR experiences, co-design labs, and digital heritage tools reinforces this trajectory.
- **Marine Renewable Energies**
  Investments in offshore wind, wave energy, and green port infrastructures are noted in S3s of Emilia-Romagna and Apulia. BEST 4.0 technologies—like predictive simulations and digital twins—can support feasibility and design phases for these projects.
- **Digitalisation of Ports and Logistics**
  Rijeka, Trieste, and Ferrara highlight the need for intelligent port infrastructure. Services around AI, process optimization, IoT, and lifecycle management offered through the DIH network are relevant here.
- **Role of the Cross-Border DIH Network**
  The DIH network established by BEST 4.0 acts as a complementary policy tool to the S3 framework, enabling coordinated service provision, knowledge transfer, and SME engagement across borders.
- **Operational Recommendations:**
  - Establish a **permanent dialogue** with S3 managing authorities and innovation agencies to embed the BEST 4.0 service framework into regional policy instruments;
  - Promote **joint policy experimentation** across regions (e.g., shared pilot calls, mutual recognition of testing protocols);
  - Use the DIH Network as a **governance layer** to monitor service demand, update innovation priorities, and scale successful models across the cooperation area.

7. Conclusion

The Cross Border Orientation Plan confirms the strong strategic coherence between the objectives of the BEST 4.0 project and the regional Smart Specialisation Strategies (S3) of the Italy–Croatia cooperation area. The findings presented in this report highlight three major outcomes:

- A **high level of alignment** between the Industry 4.0 services tested in BEST 4.0 and the innovation trajectories identified by regional S3 strategies;
- A **shared commitment** across all partner regions to promote digital transformation in Blue Economy sectors such as sustainable shipbuilding, aquaculture, smart tourism, and port digitalisation;
- The recognition of the **Cross-Border DIH Network** established through the project as a **practical and complementary policy tool**, capable of enhancing SME innovation capacity and fostering transnational cooperation.

The methodological approach based on exchange visits, regional conferences, and continuous dialogue with S3 stakeholders has enabled a bottom-up validation of services and a structured mapping of policy priorities. The analysis revealed important areas of convergence among regional S3 strategies, including sustainable aquaculture, marine technologies, coastal tourism, and green maritime infrastructure.
This convergence provides a solid foundation for the next phase of the project. In particular:

- **Under WP3**, BEST 4.0 will move into the implementation phase, testing I4.0 services through pilot actions in SMEs and collecting evidence of impact and transferability;
- The Cross-Border DIH Network will continue to act as a bridge between SMEs, innovation providers, and regional authorities;
- The project partners will formulate **policy recommendations** to ensure the long-term integration of I4.0 services into regional S3 frameworks and funding programmes.

In conclusion, the Cross Border Orientation Plan lays the groundwork for an integrated innovation ecosystem across the Adriatic, where shared priorities, aligned services, and collaborative governance can drive a sustainable and digital transition of the Blue Economy.

The Orientation Plan will guide the implementation of WP3 pilot actions and support the monitoring of service uptake and impact in relation to regional S3 trajectories, as outlined in Section 5. Through structured governance mechanisms established under the Memorandum of Understanding, the I4.0 Service Catalogue will remain a dynamic and continuously updated instrument of the Cross-Border DIH Network. In this way, the Orientation Plan consolidates its role as a strategic and operational reference framework linking territorial mapping, service implementation, and long-term policy integration across the Italy–Croatia cooperation area.