



*Research and Technology
Infrastructures: Policy, practice and
recent developments in Europe –
emerging ‘opportunities’ for the
Western Balkans”*

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Over-view of the session



Part I: Policy, practice and recent developments in Europe

- RI and TI
 - Useful definitions and illustrative examples
 - Purpose and focus
 - Strategy and policy
- Open Access:
 - Rational and Benefits
 - Scope and functioning

Part II: Regional ‘Opportunities’

- RI and TI – design of a regional ‘Twin Transition network’.
- Input from Siniša Marčić (RCC)
- Damir Medved SyntAgent
- NEWS: Supporting action.

'WHAT ARE 'RESEARCH INFRASTRUCTURES (RI) AND TECHNOLOGY INFRASTRUCTURES (TI)?'

Research Infrastructure (RI)



- **Facilities** that provide resources and services for research communities to conduct research and foster innovation.
- Can be used beyond research e.g. for education or public services.
- May be ‘single-sited’, ‘distributed’, or ‘virtual’.
- Any other research and innovation infrastructure of a ‘**unique**’ nature which is open to external users

ESS: European Spallation Source Lund SE ‘Single Sited’



Extreme Light Infrastructure: ELI 'Distributed'



World's first international laser research infrastructure

- 'pursuing unique science and research applications for international users'.

Distributed

- 3 specialized and complementary facilities
 - Czech Republic
 - Hungary
 - Romania.

First ESFRI project to be fully implemented in the newer EU Member States.

- pioneered a novel funding model
- combined EU structural funds (ERDF) + ERIC (European Research Infrastructure Consortium) contributions for operation.

- Potential for others to join? (**Centre for Advanced Laser Techniques (CALT) in HR** - an associated project and a technology supplier/collaborator.)

ELIXIR: European Research Infrastructure for life science data

Virtual and Distributed RI



A 'Hub and Spoke model'

The **Hub**, located at the Wellcome Genome Campus UK
- responsible for the overall strategy and coordination of the infrastructure.

National Nodes - centers of excellence in bioinformatics within member countries across Europe, run the actual services and resources:

- databases,
- software tools,
- training materials,
- cloud storage and
- supercomputers.



Social Science Virtual and Distributed RI



- **SHARE**: Survey of Health, Ageing and Retirement in Europe
- Purpose: to study the effects of health, social, economic and environmental policies over the life-course of European citizens and beyond
- a multidisciplinary and cross-national panel **database** of micro data on health, socio-economic status and social and family networks of about 140,000 individuals aged 50 or older (around 380,000 interviews).
- **Covers 28 European countries and Israel.**
[linked to 'sister studies' in the UK (ELSA) and US (HRS)]
- <https://share-eric.eu/>

RIs: main take-aways



- RI focus on early TRL and ‘research’ but ‘foster innovation’
- RI can be:
 - Physical/ Virtual
 - Single sited or distributed
 - May offer some opportunities for others to ‘join’
 - To be a RI the facility must be ‘OPEN’

From equipment and facilities to RI



Internal use



‘Open’ ?

- **Accessible**
- **Findable**
- **Diverse**

Users

‘Technology Infrastructure’

Definition and main characteristics

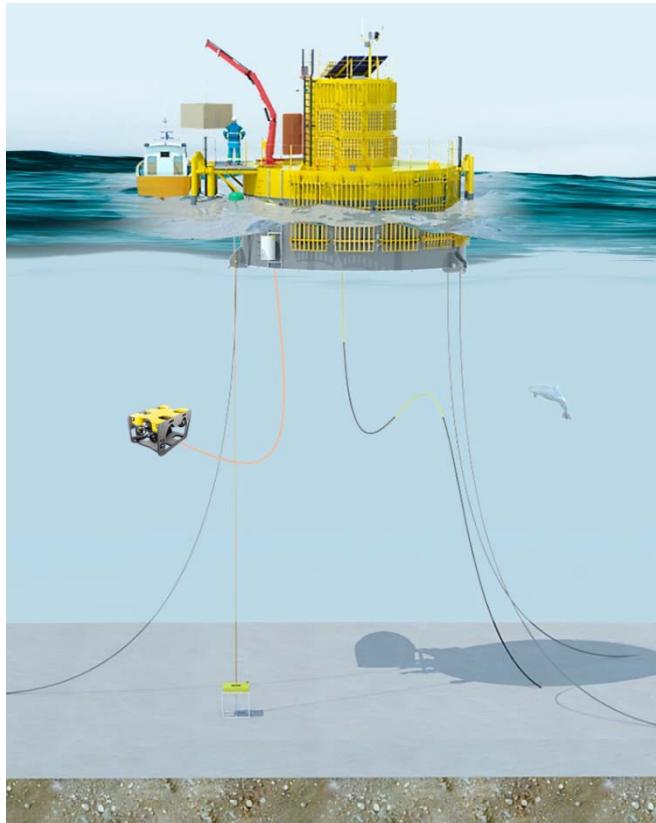


- ‘Important tools for industry to lower the costs and risks arising during technology development’
 - testing
 - prototyping
 - validation
 - Up-scaling phases.
 - Higher TRLs, more focused on innovation, more focus on enterprises (including start-ups)
- Formally recognised in 2025 – Strategy
- Earlier mentions in 2019
- (By definition ‘Open’ as aimed at enterprise and industry)

European TI examples



Tecnalia's Harsh Lab (Spain)



IT4Innovations supercomputing centre (Czech Republic)



European TI examples



Facility 4.0 ProM Facility, (Mechatronic prototyping Italy)



Renewable energy (Białystok, Poland)



RECENT CHANGES TO THE RI/TI POLICY ENVIRONMENT

European Strategy on Research and Technology Infrastructure

Choose Europe for world-class research

- Enable scientific progress
- Drive innovation
- Strengthen competitiveness

Concrete

- Scientists
- Research

Towards a European Policy for Technology Infrastructures
Building Bridges to Competitiveness

Independent Expert Report

How:

- 1 Giving scientists, researchers, innovators and industry in Europe easier access to cutting-edge facilities, high-quality data and tailored services.
- 2 Driving scientific and technological excellence, and industrial competitiveness, and bolstering our response to global challenges.
- 3 Promoting a European ecosystem of world-class research and technology infrastructures, including leading equipment, laboratories, pilot lines, and more.

Actions:

- Mobilise investments and build critical new capacity
- Maximise the potential of digitisation and artificial intelligence (AI) in European infrastructures
- Improved and simplified access to state-of-the-art infrastructure for a wider range of researchers to start-ups and scale-ups

European Charter for Access to Research Infrastructures
Principles and Guidelines for Access and Related Services

Research and innovation

POLICY ANSWERS

Funded by the European Union

Main strategic documents



- Updated 'European Charter for Access to Research Infrastructures' (2024).
- European Strategy on Research and Technology Infrastructures (15.09.2025)
- 'Towards a European Policy for Technology Infrastructures Building Bridges to Competitiveness' (02.2025)
- EU Startup and Scale-up Strategy (05.2025)

Summary of Key Enhancements in the Revised European Charter for Access to Research Infrastructures (2024 vs. 2015/2016)



Theme	Original Charter (2015/2016)	Revised Charter (2024)
Core Purpose	Non-regulatory principles for access	Updated principles reflecting modern RI landscape and research policies
Open Science	Encouraged	Explicit integration of FAIR principles
Research Security	Not explicitly addressed	Added as a key element along with strategic autonomy
User Focus	Broad users	Stronger focus on diverse users including SMEs/industry
Resilience	Implicit	Explicitly addresses resilience to crises
Operational Guidance	Traditional access modalities	Updated to reflect hybrid practices and modern infrastructure roles

Other notable points/ implications



European Strategy on Research and Technology Infrastructures

- treats **research infrastructures (RIs)** and **technology infrastructures (TIs)** as a **continuum** from scientific discovery to technology validation and up-scaling (*implies linkages/ networks...*)
- Explicit actions to simplify and **expand access for researchers, startups, scaleups and industry**, promoting use of facilities from early research through commercialization (*implies targeted funding...*)

EU Startup and Scaleup Strategy

- **Infrastructure as Core Startup Support** - Access to **infrastructures, networks and services** is highlighted as essential to growth (*implies linkages between RI/TI and startup programmes and services..*)

Towards a European Policy for Technology Infrastructures

- formalises a **definition of TIs and their role** in the innovation ecosystem
- Future TI policy will likely include **clearer roles, funding lines, and access mechanisms** tailored to innovation and industrial users



PART 2: 'REGIONAL OPPORTUNITIES' AKA: 'DESIGN YOUR OWN TECHNOLOGY INFRASTRUCTURE NETWORK'

The raw 'enterprise' potential: Start-ups and Scale-ups



Western Balkans Innovation Ecosystem

Deep-Tech & Green-Tech Projects and Programmes Summary (2025)



78

Total Deep-Tech Projects



162

Total Green-Tech Projects



54

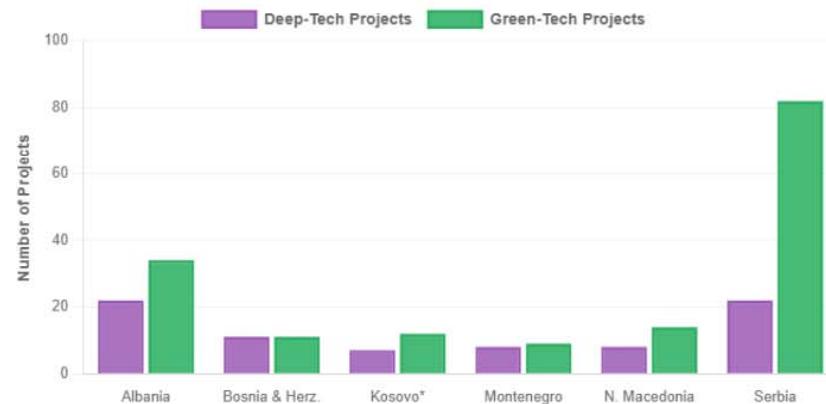
Deep-Tech Programmes



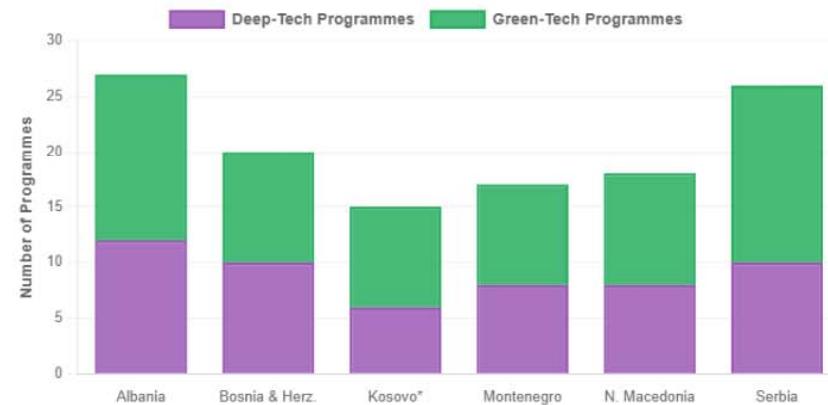
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Green-Tech Programmes

Projects by Country (Clustered)



Programmes by Country (Stacked)



Sub-sectors



Deep-tech

- advanced materials
- advanced AVML platforms
- quantum computing
- next-gen robotics, blockchain
- Biotechnology
- IoT enabled
- manufacturing, microelectronics & semiconductors
- biotechnology



Green-tech manufacturing

- renewable energy generation & storage systems
- sustainable transport tech
- circular economy
- sustainable/energy-efficient building materials & construction systems
- recycling solutions
- eco-friendly packaging

Regional Support: Hubs and programmes



Regional support for Deep-Tech

EIT WBIF EDIF EDIhs ABCD Project

Main ecosystem players in the Western Balkans

Albania	Bosnia & Herzegovina	Kosovo*
EU4Innovation Oficina Accelerator TechSpace Tirana ICTSlab	Verlab Institute SPARK Mostar INTERA Tehnopolis ICBL Banja Luka	ICK VentureUP ITP Prizren UBT Tech Park Makerspaces
Montenegro	North Macedonia	Serbia
NTP Montenegro Tehnopolis Nikšić UoM Innovation Hub	FITD UKIM Innovation Centre SEAVUS Accelerator YES Incubator FABLAB Skopje	STP Belgrade STP Novi Sad BioSense Institute STP Nis ICT Hub

Main players supporting deep-tech through funding, incubation, specialised infrastructure and KIS in the Western Balkans (mapping 2025)

Regional support for Green Manufacturing

EBRD SME Go Green WBIF EIT UNDP GIZ

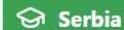
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Montenegro	North Macedonia	Serbia
NTP Montenegro Tehnopolis Nikšić University of Montenegro Innovation Hub	FITD TIDZ Industrial Zones YES Incubator FABLAB Skopje	STP Belgrade STP Novi Sad STP Nis NTP Čačak BioSense Institute

Main players supporting green manufacturing through funding, incubation, specialised infrastructure and KIS in the Western Balkans (mapping 2025)

Ranked Research Performing Organisations (RPOs) for Green Manufacturing in the Western Balkans

Ranking based on: (a) peer-reviewed manufacturing research, (b) circular-economy / green-transition engagement, (c) applied pilot capacity (e.g. BioSense). Compiled with AI deep research mode, 2025.



Serbia

Top Tier – strongest ecosystem

University of Novi Sad — BioSense Institute & Faculty of Technical Sciences (FTN)

University of Belgrade — Faculties of Mechanical Engineering & Electrical Engineering (ETF)

Indicators:

- BioSense: peer-reviewed research on sensors, precision agriculture and sustainable bio-processes; direct relevance to green, resource-efficient manufacturing and process monitoring.
- Strong EU collaboration track record (e.g. ANTARES / BioSense) showing both research quality and technology-transfer capacity.
- University of Belgrade: long history of peer-reviewed work in materials, manufacturing processes, energy efficiency and control/automation.
- Nationally leading research footprint for green process optimisation and industrial partnerships.



Bosnia & Herzegovina

High-potential Green Manufacturing RPOs

University of Sarajevo — Faculties of Mechanical & Electrical Engineering

University of Banja Luka

Indicators:

- Active in circular economy, materials and process research.
- Peer-reviewed outputs and national white papers highlight CE and sustainable production efforts.
- Mechanical/manufacturing labs enable low-carbon production pilots.
- Engineering research in process engineering, materials and telecommunications supports industrial monitoring and optimisation for greener manufacturing.



North Macedonia

Ss. Cyril & Methodius University (UKIM)

Faculty of Technology & Metallurgy

Faculty of Electrical Engineering and Information Technologies (FEEIT)

Indicators:

- Strong research in materials, manufacturing and automation.
- Peer-reviewed work in sustainable materials and manufacturing processes.
- Visible engagement in circular-economy and green-transition topics at regional level.



Albania

Polytechnic University of Tirana (PUT)

Polytechnic University of Tirana (PUT)

Indicators:

- Leading national engineering research capacity for manufacturing decarbonisation and automation.
- Peer-reviewed outputs in manufacturing engineering, automation and IT systems for industrial control.
- Core competencies for green manufacturing transitions.



Kosovo*

Growing Green Manufacturing RPOs

University for Business & Technology (UBT)

University of Prishtina

Indicators:

- Growing outputs in applied engineering, automation and digital solutions that support green manufacturing.
- Most visible sources of indexed engineering and applied-CS publications in Kosovo*.
- Work in data-driven manufacturing, cybersecurity for industry and applied automation positions them as partners for green-manufacturing digitalisation.



Montenegro

University of Montenegro (UoM)

University of Montenegro (UoM)

Indicators:

- Engineering faculties active in energy efficiency, control systems and applied manufacturing research.
- Research in power and energy systems, control and embedded systems, and applied engineering relevant for energy-efficient manufacturing and process control.
- Regional reports highlight UoM among national research leaders.



These RPOs are priority partners for green-manufacturing pilots and technology transfer in the WB region.



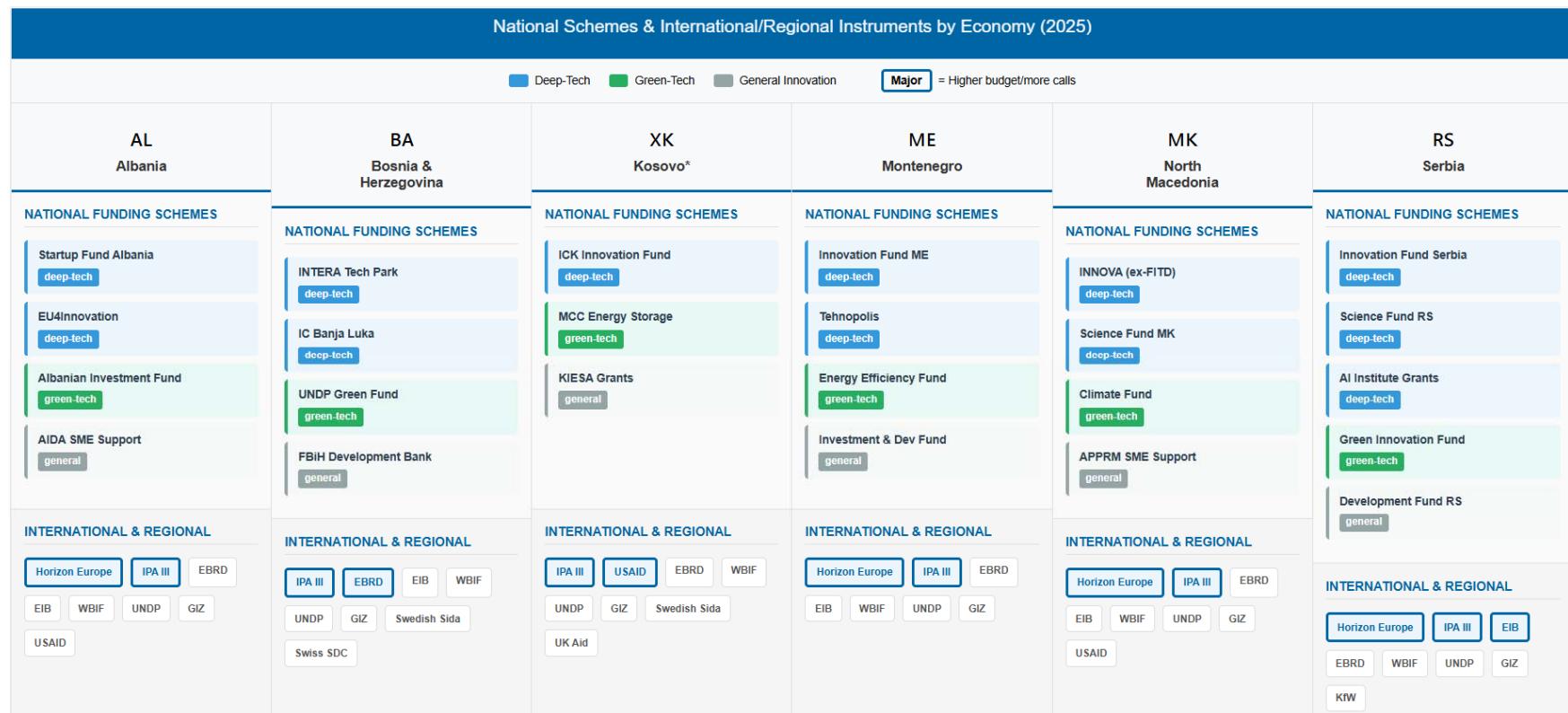
POLICY ANSWERS



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The ecosystem support: Funding





THE POTENTIAL FOR 'TWIN TRANSITION'!



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Overlaps and Synergies between Deep-Tech and Green Manufacturing Ecosystems in the Western Balkans

Multi-sector support from innovation hubs – hubs hosting both deep-tech and green-tech start-ups



Albania	Bosnia & Herzegovina	Kosovo*
■ Oficina "Deep-tech + Green"	■ INTERA "Green"	■ ICK "Deep-tech + Green"
■ TechSpace Tirana "Green"	■ SPARK Mostar "Deep-tech + Green"	■ ITP Prizren "Green"
■ EU4Innovation "Deep-tech + Green"	■ Verlab Institute "Deep-tech"	■ UBT Tech Park "Deep-tech + Green"
■ Metropolitan Incubator "Green"	■ ICBL Banja Luka "Green"	■ VentureUP "Deep-tech"
Montenegro	North Macedonia	Serbia
■ NTP Montenegro "Green"	■ FITD "Deep-tech + Green"	■ STP Belgrade "Deep-tech + Green"
■ Tehnopolis Nikšić "Green"	■ TIDZ Industrial Zones "Green"	■ STP Novi Sad "Deep-tech + Green"
■ University of Montenegro Innovation Hub "Deep-tech + Green"	■ SEAVUS "Deep-tech"	■ BioSense Institute "Deep-tech"
 	■ YES Incubator "Green"	■ STP Nis "Green"
 	■ FABLAB Skopje "Deep-tech + Green"	■ NTP Čačak "Green"

■ Green = Green Manufacturing Hubs

■ Blue = Deep-Tech Hubs

■ Yellow = Mixed / Cross-sector Innovation Hubs

PRO strengths mapped by sub-sector



Economy		Organisation	Sub-Sectors												
Country	University		1. Circular economy	1. Eco-friendly packaging	1. Recycling Solutions / Sustainable / energy-efficient	1. Renewable energy generation & transport tech	1. Sustainable transport tech	1. Microelectronics & semiconductors	1. IoT-enabled manufacturing	1. Biotechnology	1. Blockchain	1. Next-gen robotics	1. Quantum computing	1. Advanced AV/ML platforms	1. Advanced materials
Serbia	Univ. of Belgrade (ETF, Mech.)	■	■	□	■	■	■	■	■	■	■	■	■	■	■
Serbia	Univ. of Novi Sad (+ BioSense)	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Bosnia & Herzegovina	Univ. of Sarajevo (Eng)	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Bosnia & Herzegovina	Univ. of Banja Luka (Eng)	■	■	■	■	■	■	■	■	■	■	■	■	■	■
North Macedonia	UKIM (FEEIT / Tech & Metallurgy)	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Montenegro	Univ. of Montenegro	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Albania	Polytechnic Univ. of Tirana (UPT)	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Albania	Univ. of Tirana	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Kosovo*	University of Prishtina	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Kosovo*	UBT (University for Business & Technology)	■	■	■	■	■	■	■	■	■	■	■	■	■	■

‘Twin transition’ synergies – sub-sector overlap



Deep-Tech and Green Manufacturing Synergies

	Renewable Energy Hardware & Smart Grids	Circular Economy & Waste Valorisation	Sustainable Construction & Materials	Energy-Efficient Industrial Automation	Eco-Product Design & Packaging	Sustainable Transport Tech
AI & Data	Smart forecasting Grid optimization Predictive maintenance	Waste stream analytics		Process optimization Energy efficiency ML models		Route optimization Fleet management
IoT & Sensors	Real-time monitoring Smart meters Grid sensors	Sorting sensors Quality control	Building sensors Climate control	Real-time energy monitoring Industrial IoT		Vehicle sensors Emissions tracking
Robotics & Embedded Systems		Automated sorting Disassembly robots Material recovery	Modular construction robots	Industrial automation Cobots Precision control		Assembly automation EV production
Advanced Materials	Battery materials Solar efficiency	Recycled materials Upcycling tech	Bio-composites Insulation materials Low-carbon cement		Biopolymers Recycled composites Biodegradable packaging	Lightweight materials Efficiency gains
Biotech & Bio-processes	Biofuels Bio-hydrogen	Bio-based recycling Biogas production Enzyme catalysis	Mycelium materials Bio-insulation		Bio-plastics Organic packaging Compostable products	
Digital Platforms & Blockchain	Energy trading P2P platforms	Material tracking CBAM compliance Supply chain transparency	Building passports Material traceability		Product lifecycle tracking	Mobility platforms Carbon tracking

Synergy Strength Legend

Strong Synergy – High priority areas for joint deep-tech and green manufacturing initiatives

Light Synergy – Limited current overlap, potential for future development

Medium Synergy – Emerging opportunities with moderate integration potential

Priority synergy spaces for RCC and WB6 policymakers to support industrial competitiveness and green transition

Matrix identifies technology convergence opportunities for sustainable industrial development in the Western Balkans

 **POLICY ANSWERS**



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The Cross sector **regional** potential



Cross-sectoral value-chain opportunities

1. AI & Data-Driven Optimization \times Industrial Energy Efficiency
2. Advanced Materials \times Circular Economy & Eco-Packaging
3. Robotics & Automation \times Waste Management and Recycling
4. Sensors & Microelectronics \times Renewable Energy Systems
5. Digital Platforms \times Circular Business Models

Example high -impact “white spaces” for innovation

1. Pilot lines for production-line efficiency and smart energy management.
2. Production of eco-packaging for regional food and cosmetics industries.
3. Waste collection, sorting and recycling processes.
4. Smart renewable energy systems: affordable microgrid controllers or battery management units.
5. Tools for circular economy needs.

Cross-Sectoral Opportunity RI/TI Spaces



Pilots and scale-ups need to be supported by RPO/ RI and Hubs/TI

- **Smart, energy-efficient manufacturing (Industry 4.0)** — AI/IoT + automation pilots to reduce energy intensity in metal, textile and food plants (**INTERA, STP Belgrade, STP Niš, BioSense, VERLAB**).
- **Advanced & sustainable materials** — R&D + prototyping for biopolymers, recycled composites and eco-packaging (**UKIM, BioSense, INNOVA, TechSpace, Tehnopolis**).
- **Renewables hardware & systems + smart grids** — modular solar/wind + storage assembly and AI-enabled optimisation (**ICK/UBT, NTP Montenegro, STP Belgrade, University of Montenegro**).
- **Circular economy & waste-to-product technologies** — robotics for sorting, waste valorisation pilots and market platforms (**INTERA, VERLAB, TechSpace, INNOVA**).
- **Sustainable product / packaging design & local assembly** — prototyping and small-scale manufacturing of compostable packaging and eco-products (**TechSpace, Tehnopolis, FABLAD/INNOVA partners**).

GM: Best Ecosystem Matches by Sector/ Sub-sector



Deep-Green Opportunity Spaces – Key Ecosystem Hubs in the Western Balkans

Listing compiled with AI deep research mode (2025)

A. Sustainable Materials & Advanced Materials	B. Circular Economy & Waste Valorisation	C. Renewable-Energy Hardware / Manufacturing	D. Industrial Automation & Energy-Efficient Production	E. Sustainable Packaging & Eco-Product Design
<p><i>Hubs focused on new materials, composites and advanced fabrication.</i></p> <p>INTERA Technology Park Bosnia & Herzegovina Additive manufacturing, CNC, composites.</p> <p>Tehnopolis Montenegro Materials testing, agri-materials, food packaging.</p> <p>STP Niš Serbia Microelectronics and material-integrated systems.</p> <p>FABLAB Skopje North Macedonia Materials prototyping.</p>	<p><i>Innovation for reuse, recycling and waste-to-resource models.</i></p> <p>YES Incubator North Macedonia Active circular economy programmes.</p> <p>SPARK Bosnia & Herzegovina Digital circular solutions, waste-tech.</p> <p>TechSpace Tirana Albania Circular product design.</p> <p>UNDP Accelerator Labs all WB economies Waste-to-resource challenge support.</p>	<p><i>Hardware and system solutions for the energy transition.</i></p> <p>STP Belgrade Serbia Cleantech entrepreneurship.</p> <p>UBT Tech Park Kosovo* Renewable energy R&D support.</p> <p>NTP Montenegro Montenegro Clean energy system design.</p> <p>FITD North Macedonia Funds renewable hardware prototypes.</p>	<p><i>Industry 4.0, robotics and energy-optimised processes.</i></p> <p>INTERA Technology Park Bosnia & Herzegovina Robotics, automation, Industry 4.0.</p> <p>STP Novi Sad Serbia IoT for smart manufacturing.</p> <p>Tehnopolis Montenegro Process optimisation.</p> <p>ICK Kosovo* Digital manufacturing tools.</p>	<p><i>Eco-products, packaging and design-driven circularity.</i></p> <p>Tehnopolis Montenegro Packaging R&D (food/agri-tech focus).</p> <p>TechSpace Tirana Albania Prototyping eco-friendly consumer goods.</p> <p>INTERA Bosnia & Herzegovina 3D printing & design labs.</p> <p>YES Incubator North Macedonia Circular-product entrepreneurship.</p>

‘Opportunity’



**JOIN FORCES, INVEST IN
‘TWIN-TRANSITION’ TI
AND REALISE POTENTIAL!**

Making RI and TI ‘Open’



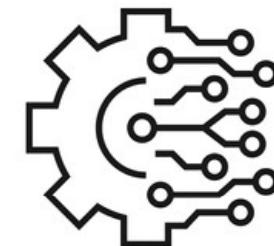
Papers/ Publications: FAIR

- Findable
- Accessible
- Interoperable
- Reusable



Infrastructure?

- (Legally) Accessible
 - Workable OA Policy for diverse users
- Affordable
 - Existence of funding support
- Findable
 - Well promoted
- Supported
 - TI Hub Services





- **MAKING REGIONAL RI AND TI 'OPEN':
VISIBILITY AND ACCESS**

- **SINIŠA MARČIĆ RCC**
- **DAMIR MEDVED SYNTAGENT**

Support on the 'Horizon'

WINGS: Widening Innovation through Networking, Growth and Skills



WP3

- Identification and adoption of a set of **core KT services**.
- Linked to **RI and TI**.
- **Support for adoption** by established service champions.
- Led by **KTU** (Lithuanian Valleys).
- RCC is a full PP in WINGS.



Discussion, comments, questions



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